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PHOTOGRAPHIC INTELLIGENCE CENTER - REPORT 1

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Japanese ELECTRONICS

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by Ray M. Stroupe

RAY M. STROUPE
Capt., Inf

NØ-10405

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AIR INTELLIGENCE GROUP, DIVISION OF NAVAL INTELLIGENCE
OFFICE OF THE CHIEF OF NAVAL OPERATIONS, NAVY DEPARTMENT

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PHOTOGRAPHIC INTELLIGENCE REPORT

UNCLASSIFIED

JAPANESE ELECTRONICS

- RADAR
- RADIO
- DIRECTION FINDING
- NAVIGATIONAL AIDS

UNITED STATES NAVAL PHOTOGRAPHIC INTELLIGENCE CENTER
NAVY YARD, WASHINGTON 25, D.C.

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FOREWORD

Purpose of Report:

1. To compile a pictorial reference on Japanese Electronics installations.

2. To develop Photographic Interpretation techniques for extracting needed information on Electronics from aerial photographs.

3. To present coordinated Electronics information in combination with Photographic Interpretation data in order to supply maximum intelligence on enemy installations.

Additional looseleaf pages will be issued to holders of this report at such times as important new information becomes available.

CHARLES H. COX

Lieutenant Colonel, USMCR

Officer-in-Charge

Photographic Intelligence Center

[redacted]

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ACKNOWLEDGMENT . . .

is made to all of the many military activities from whom advice, criticism and published material has been sought in the process of writing this report, and in particular to the personnel of the NAVAL RESEARCH LABORATORY who have contributed freely of their time and invaluable information.

TABLE OF CONTENTS

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CONTENTS

INTRODUCTION

GLOSSARY

Collectors . . .	Antennae used in connection with D. F.
Echo	A radar pulse returned to its source by reflection from a solid surface.
Dipole	Pole or rod antennae fed at middle of pole or rod.
Ground clutter .	Signals on a radar indicator caused by reflections of transmitted pulses from land or cultural features.
Indicator . . .	The radar scope or screen on which signals are visually presented.
Kilocycle . . .	1000 cycles.
Lobe	A definite beam of radiation emitted by a radar antenna.
Lobe switching .	Method of electrical operation in certain fire control radars for getting fix on plane.
Mast	Term used for vertical member which supports antennae used in connection with radio installations.
	Stick mast - Single trunk made of wood or steel and may be guyed.
	Lattice mast - Mast designed of several members, assembled in a criss-cross pattern for height and strength. Usually of steel but may be wood.
Megacycle . . .	1,000,000 cycles (or 1000 kilocycles).
Permanent echoes	(See ground clutter).
Propagation . .	The manner in which radar waves travel along the earth.
Pulse	Radiation (of radar waves) emitted in short burst.
Radiating mast .	Metal mast which acts as antenna in itself.
Range marks . .	Linearly spaced marks on the indicator for estimating the ranges of targets.
Refraction	Bending of a radar beam by air strata of differing densities.
Scope	(See Indicator).
Sensing Antenna	Central antenna used with an Adcock D. F.
Trace	Line of light on the indicator caused by the oscillating spot.
Unipole	Pole or rod antennae element fed at end of pole or rod.

$$\text{Frequency (Kcs)} = \frac{\text{Speed of light (meters)}}{\text{Wave length (meters)}}$$

ABBREVIATIONS

P.P.I.	Plan Position Indicator (Scope)
R.P.D.	Radar Planning Device
Kcs.	Kilocycles Per Second
Mcs.	Megacycles Per Second
P.R.F.	Pulse Repetition Frequency

SYMBOLS

STANDARD SYMBOLS FOR USE IN PHOTOGRAPHIC INTERPRETATION.

All symbols which are normally used in connection with the interpretation of electronics installations are included in this list.

ELECTRONICS	
DIRECTION FINDER	
POWER STATION	
POWER TRANSMISSION LINE (OBSTRUCTION)	
POWER TRANSMISSION LINE (NOT OBSTRUCTION)	
RADAR	
RADIO NAVIGATIONAL AID	
RADIO STATION	
RADIO TRANSMITTER	
SEARCHLIGHT	
SEARCHLIGHT - RADAR CONTROLLED	
SOUND LOCATOR	
TOWER, CONTROL	

TOWER, LIGHT	
TOWER, RADIO	
TOWER, SIGNAL	
TELEPHONE OR TELEGRAPH LINE	T . . . T
TRANSFORMER STATION	
WEATHER STATION	
OBSERVATION TOWER	OP
ANTI AIRCRAFT	
HEAVY - 75 MM AND OVER	
FIRE CONTROL CENTER	
FIRE CONTROL RADAR	
FIRE CONTROL VISUAL	
UNIDENTIFIED	(?)

GENERAL

It was found necessary in creating a report of this type, to make numerous interpretations in widely separated areas throughout the world. In some few cases, conclusions drawn are not in complete agreement with other reports on the same installations.

In most cases methods of reasoning and assumptions on which the interpretations were based are set forth in the various section of this report.

It is the announced aim of the study to create, record and disseminate an "interpretation approach" and techniques for locating and classifying Japanese Electronics installations.

It follows, then, that the study may serve the Armed Forces best if it is (1) accurate, (2) clearly catelogued and indexed, and (3) represents a common language for use of interpretation and electronics officers.

It is requested, therefore, that any differences of opinion, errors found or additional information be directed to the Photographic Interpretation Center. Additions and corrections will be made in looseleaf form and forwarded immediately for inclusion in all copies of this report.

INTRODUCTION

JAPANESE ELECTRONICS

Prepared November 1944, replaces "Japanese Radio-Radar and Related installations" (P.I.C. No. 2 - 5/6/8/9/-K-1/44) and is a revised and enlarged edition of the latter. (Certain examples of German Electronics are included because of German equipment and technicians available for Japanese use.)

For further and detailed information on Japanese electronics equipment see Naval Research Laboratory Report #RA3A215B entitled: "Technical Data on Japanese Radio and Radar Equipment."

This report deals mainly with four distinct types of electronics installations. The interpreter should clearly understand the exact functions of each.

RADAR
(Radio Detecting and Ranging)

1. Transmits and receives.
2. Provides early warning of approaching aircraft and surface vessels.
3. Used in connection with gunfire to give accuracy of range and deflection (called "Fire Control" type).
4. May be used for Navigational purposes.

COMMUNICATIONS
("Radio")

1. Transmits and receives spoken word or code.

DIRECTION FINDERS
(Receives Radio Signals)

1. Detects radio and records range and direction.
2. Aid to Navigation - It is believed this is a primary use of Japanese installations.

NAVIGATIONAL AIDS
(Navigational Beam)

1. Transmits radio signals creating a "beam" for guiding ships and planes to home base or to bombing target.

Tendencies towards standardization are an inevitable outgrowth of development, especially in the electronics field. Because of this, the interpreter's job with respect to newly covered installations becomes easier in direct proportion to his familiarity with the old or captured installations.

It is with this purpose in mind that a large number of photographic examples of known installations are included and an attempt made to group them in a logical manner, reflecting their use in waging war.

Frequencies are given in connection with all installations, to enable the interpreter to check his visual interpretation against frequency data obtained from radio signals picked up from any particular area.

SCALE

In order to establish a more realistic yardstick of the possibilities of electronics interpretation, the following table of photographic scales is prepared.

The first column represents the smallest scale at which the object may usually be recognized.

The second column suggests a scale at which a good detailed interpretation can usually be made.

It is assumed that good quality prints are available and that the interpreter knows what he is looking for.

RADAR	RECOGNITION	DETAIL
Fixed types	1/10000	1/5000
Mobile types	1/8000	1/5000
Fire Control	1/5000	1/2000
COMMUNICATIONS		
Lattice masts	1/15000	1/8000
Stick masts	1/10000	1/5000
DIRECTION FINDERS		
Open Adcock	1/18000	1/11000
Housed Adcock	1/15000	1/10000
Portable or unusual types	1/8000	1/5000

NAVIGATIONAL AIDS
Vary considerably in size and type.

FREQUENCIES

RADAR . . . . . VHF, UHF, SHF (30-30000 Mcs.)
COMMUNICATIONS . . . . . VLF, LF, MF, HF, VHF (0.01-30 Mcs.)
DIRECTION FINDERS . . . . . MF, HF (0.3-30 Mcs.)
NAVIGATIONAL AIDS . . . . . LF, MF, HF, VHF (0.03-300 Mcs.)

In general: low frequencies indicate long ranges; high frequencies indicate short ranges. This is true of all types of electronics shown.

STANDARD FREQUENCY TABLE

SHF -- Super High Frequency . . . . 3000-30000 Mcs. ("microwave")
UHF -- Ultra High Frequency . . . . . 300-3000 Mcs.
VHF -- Very High Frequency . . . . . 30-300 Mcs.
HF -- High Frequency . . . . . 3-30 Mcs.
MF -- Medium Frequency . . . . . 300-3000 Kcs. (0.3-3 Mcs.)
LF -- Low Frequency . . . . . 30-300 Kcs. (0.03-0.3 Mcs.)
VLF -- Very Low Frequency . . . . . 10-30 Kcs. (0.01-0.03 Mcs.)
D.F. -- . . . . . Direction Finder.

SECTION-I

1.01 — 1.99

RADAR

In an effort to eliminate confusion with respect to Japanese Radar Designations, the following table is included. In cases where popular names have developed, the popular name is used for page headings.

JAPANESE RADAR DESIGNATIONS

POPULAR NAME	JAPANESE TEMPORARY DESIGNATION	JAPANESE ABBREVIATED DESIGNATION
"Guadalcanal" type	Mark 1, Model 1	Mark 11
"Attu" type	Mark 1, Model 1, Modification 1	Mark 11
"Mobile Mattress"	Mark 1, Model 2	Mark 12
"Mark 6 Portable"	Air Mark 6 "Special"	?
"Mark 13 Portable"	Mark 1, Model 3	Mark 13
"Wewak Yagi"	"YA"	Mark 8 ?
"Chi"	"Chi"	Mark 229
"Ship Mattress"	Mark 2, Model 1	?
Ship "2-Horn" type	Mark 2, Model 2	Mark 51
Ship "3-Horn" type	Mark 2, Model 2 Modification 2	Mark 61
"Parabaloid"	Mark 2, Model 3	Mark 52
_____	Air Mark 6, Model 4	Mark 6
_____	Mark 4, Model 1	Mark 21
_____	Mark 4, Model 2	Mark 21
_____	Mark 4, Model 3	Mark 42?
_____	Mark "TA", Model 1	?
_____	Mark "TA", Model 2	?
_____	Mark "TA", Model 3	?

RADAR
SUMMARY

In principle, all Radar systems are alike, although individual installations may vary widely in physical aspects as well as tactical use. Examples of land based, airborne, and ship mount radar are shown and discussed in this section.

Simply stated Radar is an electronic device which emits continuous stream of radio waves of extremely high frequencies (70 to 30,000 Mcs.) which, when reflected back from a dense obstruction in their path, are received and presented on a cathode ray tube to record position and range of that obstruction in a visual manner.

Each installation both transmits and receives.

Radar will not penetrate land forms, buildings, ships and planes, and, therefore records them by reflection. Generally, Radar will penetrate clouds and foliage, however, rain-laden dense cumulus clouds may be picked up, as may be dense forest.

Radar waves travel in a straight line except for atmospheric refraction which bends the beam earthwards, and which is important beyond the 20 mile range. Very little is known as yet concerning the exact effects of refraction (called "propagation"). However, it is considered reasonable, in order to plot radar waves as a straight line, to regard the earth as being 4/3 of its actual diameter when calculating the effect of curvature of the earth on radar "shadows" under "standard" weather conditions.

LAND BASED SEARCH RADAR

The Japanese often locate search Radar on high points in mountainous areas, and on a high concrete base in low flat areas. This enables the radar to search greater ranges close to the earth's surface. Radar sites are very often near the seacoast.

When two Radars are used in close proximity it is likely to be for the following reasons:

1. One may search while the other tracks objective.
2. Two may be required to complete coverage of all required sectors of search.
3. The additional set may be erected as a supplementary installation in the event of damage or malfunctioning of the first set.

It is important that interpreters learn to associate the graphic appearance and sizes of Radar types with their known frequency band, for as information on signals received is usually available, it is possible to make a positive and exact identification in this way.

INTERPRETATION FEATURES

1. Size and shape of screen.
2. Blast wall sometimes present (example: Kiska).
3. Often mounted on high concrete base, particularly low coral islands (example: Makin).
4. Generator building often visible (example: Marcus).
5. May be found as twin installation (example: Kiska).
6. Site will be free from dense obstructions in area of required coverage.

REPORTING ON SEARCH RADAR

In Photographic Interpretation reports on radar installations, the following information is desirable :

1. Exact location and elevation above sea level.
2. Probable area of search (nearby obstructions etc.).
3. Height of screen above ground.
4. Generator Building location - if visible.
5. Size and shape of screen (note particularly if parabolic or horn.)
6. Operation of screen.
   (a) fixed
   (b) rotates
   (c) elevates
   (d) tips upward
7. Design of base for screen.
8. Probable use of installation.
9. Type of radar - if known.
10. Frequency, Pulse Length, Pulse Frequency.

RANGE

Ranges of Radar equipment cannot be cited in exact figures due to variations caused by weather conditions, size of objective, radar operators skill etc. However, rough ranges are given in connection with each type in the following pages.

The concern of the Japanese with respect to Radar and its development and use is expressed in the following excerpt from a captured Japanese notebook, probably written from a class lecture early in 1944.

"The value of radar (in firing action) is tremendous. We must quickly marshall its full capabilities since it is the very essence of the present war of science. Great advantages can be gained by progress in radar. Those responsible for meeting the present war situation in its tactical phases must examine the essential elements and endeavor to obtain maximum efficiency in both men and equipment in the Imperial Navy. A glance at the present condition of the fleet reveals that the ships of those with an active interest (TN: in radar) are well-equipped in all essential details and the accuracy of some of the equipment has exceeded all expectations. On the other hand there are many who lack confidence in its use and feel that radar is a white elephant on their hands. We must strive all the more for the perfection of radar by further research and training."

RADAR
SUMMARY (CONT.)

TABLE OF IMPORTANT JAPANESE RADAR TYPES

	POPULAR NAME	JAPANESE DESIGNATION	ANTENNA	FREQUENCY IN MCS.	P.R.F. IN CPS.	PULSE LENGTH IN MICROSECONDS	MAXIMUM RANGE IN NAUTICAL MILES						USE	REMARKS	PAGE NO.
							A/C Form	A/C Single	BB CA	CL	DD	SS			
LAND-BASED SEARCH	GUADALCANAL TYPE	MARK 1, MODEL 1	26'x18'	97-103	880-1200	12-30	75	35-45	13	10	8	--	A.W.	FIRST FOUND ON GUADALCANAL	1.05
	"ATTU TYPE"	MARK 1, MODEL 1 MODIFICATION 1	28'x14'x2 1/3'	97-103	880-1200	12-30	75	35-45	13	10	8	--	A.W.	'BOX' TYPE ANTENNA	1.10
	"MOBILE MATTRESS"	MARK 1, MODEL 2	14'x7'x1 2/3'	187-205	800-1500	3½-12	100	75	--	--	--	--	A.W.	OFTEN FOUND EMPLACED IN A REVETMENT	1.14
	"MARK VI PORTABLE"	AIR MARK VI "SPECIAL"	7' YAGI DIPOLES MOUNTED ON COLLAPSIBLE TRIPOD	140-160	1000	3-5	75?	--	--	--	--	--	A.W.	PORTABLE ADAPTATION OF AIR-BORNE SET	1.16
	"MARK 13 PORTABLE"	MARK 1, MODEL 3	VARIOUS-USING ARRAYS OF 7' YAGI DIPOLES	140-160	500	10	45	--	--	--	--	--	A.W.	MAY BE IMPROVED AIR MARK VI WITH HIGHER POWER. SET IS PORTABLE.	1.16
	"WEWAK TYPE"		2 HORIZONTAL ROWS OF (YAGI?) DIPOLES ON A MAST	60-80	750	25-35	125	90	--	--	--	--	A.W.	TRANSPORTABLE PHOTOGRAPHED AT WEEWAK 1943. INCREASING USE.	1.17
	"CHI"	"CHI" OR MARK 229	SIMILAR TO WEWAK TYPE"	60-80	500 OR 1000	25-35	125	90	--	--	--	--	A.W.	FIXED TRANSMITTER T. AND R. ARE AT SEPARATE LOCATIONS. INCREASING USE.	1.17
SHIP-BORNE	"SHIP MATTRESS"	MARK 2, MODEL 1	14'x7'x1 2/3' (SIMILAR TO MOBILE MATTRESS)	187-205	1000	10	100	75	20	15	12	--	A.W. S.W.	SAME AS MOBILE MATTRESS WITH A DIFFERENT ANTENNA MOUNT.	1.18
	"2-HORN TYPE"	MARK 2, MODEL 2	2 ELECTRO-MAGNETIC HORNS APPROX. 3' LONG	3000	2500	6	--	--	25	18	12	8	S.W.	HORNS MAY BE IN TURNTABLE. RECEIVER IS HIGHER THAN TRANSMITTER.	1.18
	"3-HORN TYPE"	MARK 2, MODEL 2 MODIFICATION 2	3 ELECTRO-MAGNETIC HORNS APPROX. 3' LONG	3000	2500	6	--	--	25	18	12	8	S.F.C. S.W.	RECEIVER HORN IS REPLACED BY DOUBLE HORN ATTACHMENT	1.18
	"PARABALOID"	MARK 2, MODEL 3	PROBABLY PARABALOID	520	---	30	--	25	15	--	--	--	S.W. A.W. F.C.A?	FOR SMALL CRAFT. PROBABLY ADAPTATION OF GERMAN WURZBURG. (CAPTURED DOCUMENTS ONLY)	--
AIR-BORNE		AIR MARK VI MODEL 4	VARIOUS: YAGI, DIPOLES, ARRAYS	140-160	1000	3-5	15	10	25	18	12	--	A.S.V. A.I.	FIRST USED IN BETTY. NOW IN ALL TYPES OF PLANES WITH VARIOUS ANTENNA DESIGNS	1.20
FIRE AND SEARCHLIGHT CONTROL							ACCURACY RANGE	ACCURACY BEARING	ACCURACY ELEVATION						
		MARK IV, MODEL 1 (S-3)	MATTRESS 25 3/4'x6'x4'	200	2000	3-5	50 YDS	0.5°	0.5°				A.A.F.C. A.W.	ADAPTATION OF OUR SCR 268	1.25
		MARK IV, MODEL 2 (ALSO MODIF. 2)	PROBABLY MATTRESS	200	1000	3	50 YDS	0.5°	0.5°				A.A.F.C. A.W.	SMALLER AND IMPROVED MK IV, MODEL 1 FOR MASS PRODUCTION (CAPTURED DOCUMENTS ONLY)	1.25
		MARK IV, MODEL 3	4 YAGIS ON S/L 1 YAGI ON S/L CONTROLLER	200	2000	3-5	100 YDS	1°	1°				A.A.F.C. S.L.C.	SIMILAR TO BRITISH "SLC" BUT TRANSMITTING ANTENNA SEPARATED	1.22
		MARK "TA", MODEL 1	4 YAGIS WITH TRANS. ANTENNA ATTACHED ABOVE	200	---	3	--	--	--				A.A.F.C.	(CAPTURED DOCUMENTS ONLY)	1.23
		MARK "TA", MODEL 2	5 YAGIS - EACH WITH REFLECTOR	200	1000	2	100 YDS	--	--				A.A.F.C. A.W.	(CAPTURED DOCUMENTS ONLY)	1.23
		MARK "TA", MODEL 3	ELABORATE ANTENNAE SYSTEM T/R SEPARATED	75?	1000-2000	1-2	25 YDS	0.5°	1°				A.A.F.C.	ADAPTATION OF BRITISH "GL" MARK 2 (CAPTURED DOCUMENTS ONLY)	1.24

P.R.F. - PULSE REPETITION FREQUENCY
C.P.S. - CYCLES PER SECOND

A.W. --- AIR WARNING
S.W. --- SURFACE WARNING
S.F.C. - SURFACE FIRE CONTROL

A.A.F.C.-A/A FIRE CONTROL
S.L.C. - SEARCHLIGHT CONTROL
A.S.V. - AIRPLANE SEARCH FOR SURFACE CRAFT
A.I. --- AIRBORNE INTERCEPT

NOTE: IN ADDITION TO THE ABOVE, GERMAN RADAR TYPES MAY BE FOUND IN USE IN JAPANESE CONTROLLED AREAS.

The following diagrams were prepared by the Special Devices Division of the Bureau of Aeronautics, Navy Department, for use in connection with terrain models and special R.P.D. equipment.

They are included here because they constitute a rapid way of estimating enemy radar coverage, with or without the use of terrain models.

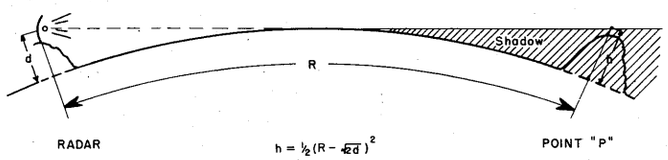
Charts, prepared by Gen. Hq., S.W.P.A., are available for plotting Japanese Radar coverage and propagation according to type of Radar and number of A/C in formation.

Curvature can be neglected within 20 miles of the radar site, and outside of that range relatively few curvature computations are required. These computations fall into two simple classes:

CASE I: OPEN SEA BETWEEN RADAR AND OBJECT. In this case no shadow will be present on the flat model. Referring to diagram, if "h" is greater than the height above sea level of the terrain at "P", no ground echo will appear on the radar.

EARTH CURVATURE

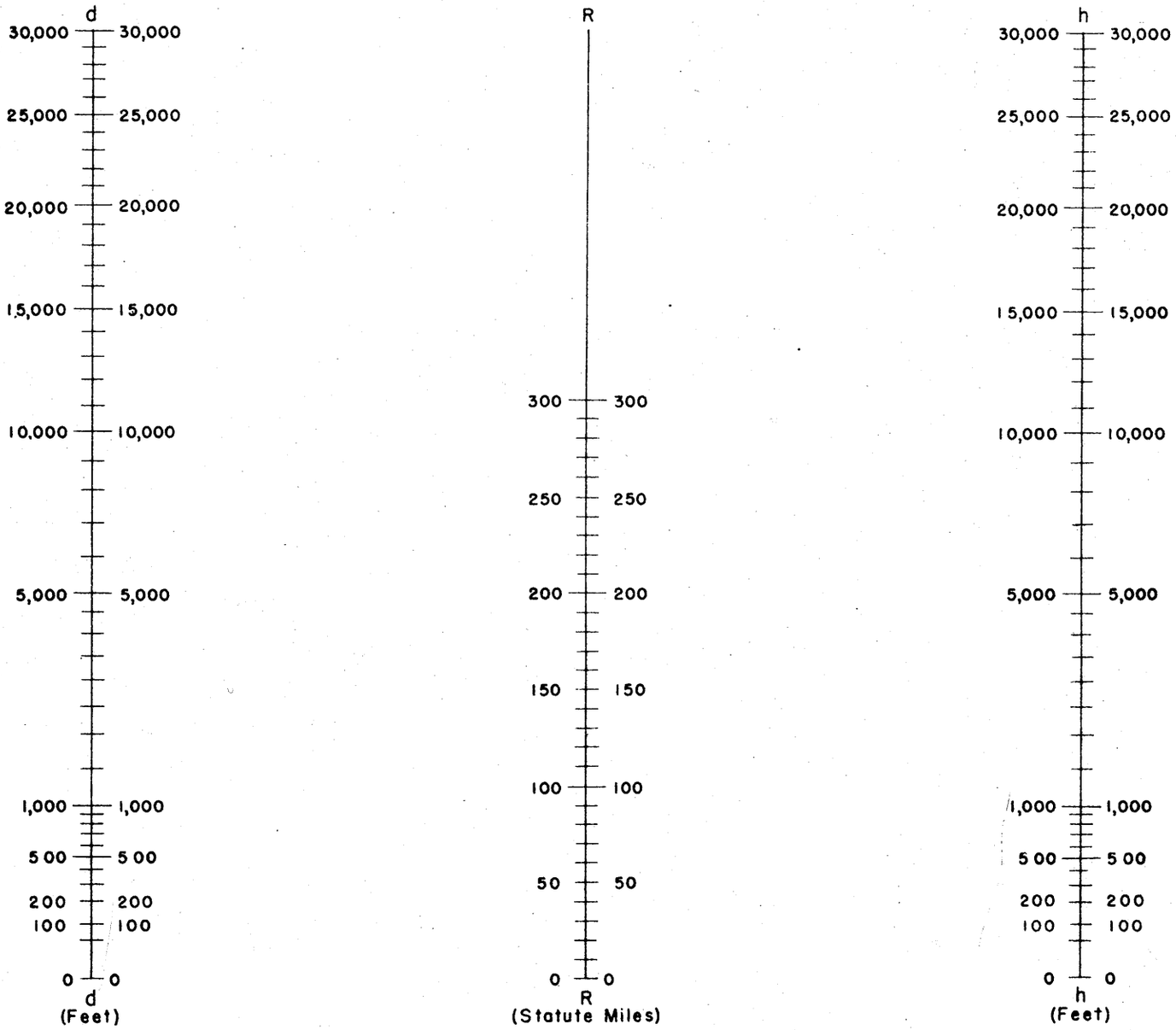
Case 1: Open Sea Between Radar and Object



d = HEIGHT OF RADAR ABOVE SEA-LEVEL
R = RANGE OF "P" FROM RADAR
h = HEIGHT OF SHADOW AT "P" DUE TO CURVATURE

HOW TO USE NOMOGRAPH

Pass a ruler through the points on the two vertical lines representing known quantities, and read off the solution at the intersection of the third line with the ruler.



Example: If the radar is at 1250 feet, the shadow height at 200 miles is found by lining up the ruler with "d" = 1250 and "R" = 200. The ruler will then pass through "h" = 11,250 feet, which is the solution.

RADAR

SUMMARY

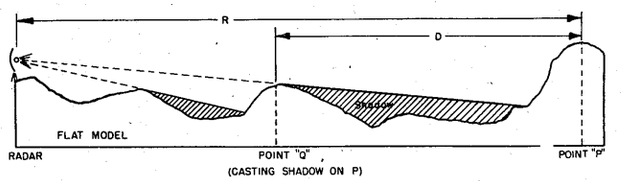
CASE 2: SHADOW CAST BY A TERRAIN FEATURE IN THE FOREGROUND. In this case the shadow edge at a point "P" will be raised by earth curvature by an amount which depends on the range of "P" and the distance between "P" and the feature which casts the shadow. Referring to page 42, if the amount which the mountain at "P" protrudes above the shadow edge on the flat model is less than the computed "h", the effect of curvature will be to remove the mountain from the beam.

Whenever a hill is found to disappear into shadow as a result of curvature computations, a shadow cannot be cast by this hill on objects still more distant. Should such a problem arise, elevate the hill with a pencil or any convenient object to the computed shadow edge, and use the new shadow (cast on the more distant object by the pencil) as the basis for making a case 2 computation.

Note: In rare cases, it may be difficult to decide whether case 1 or case 2 applies. In such circumstances apply both, and take the higher of the two computed shadows.

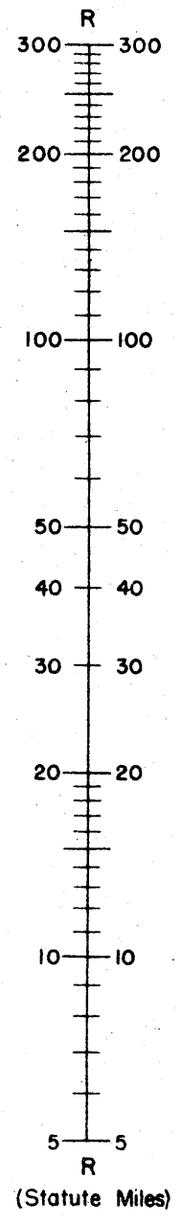
EARTH CURVATURE

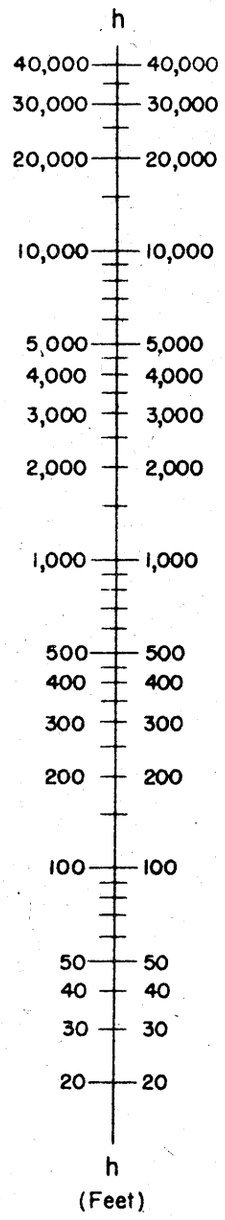
Case 2: Shadow Cast By Terrain Feature in Foreground.

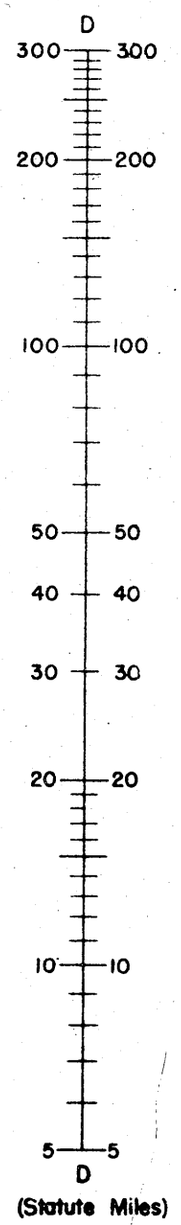


h = 1/2 RD

R = RANGE OF "P" FROM RADAR.
D = DISTANCE FROM "P" TO "Q".
h = ADDITIONAL SHADOW-HEIGHT AT "P" DUE TO CURVATURE.



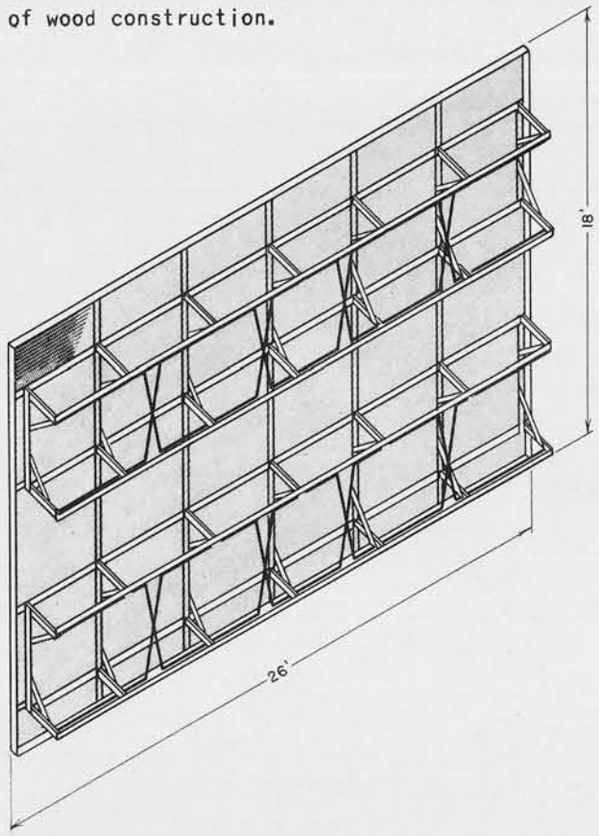




Example: Suppose the distant point "P" is at a range of 200 miles, and the object casting a shadow on "P" is at a distance of 150 miles from "P". Passing the ruler through "R" = 200 and "D" = 150, the answer "h" = 15,000 feet will appear at the intersection of the ruler and the center scale.

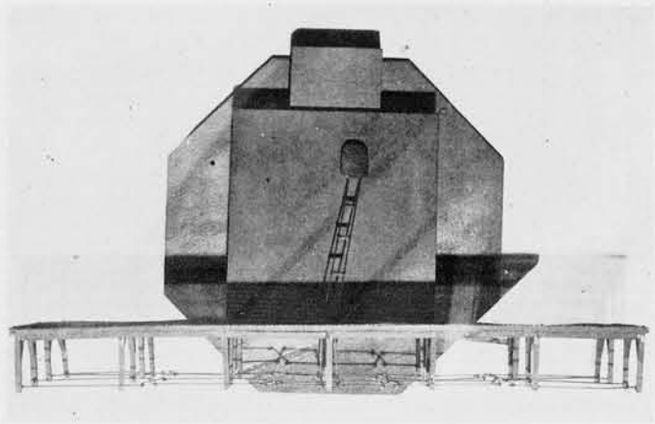
RADAR
GUAD. TYPE

The first captured Japanese Radar, found on Guadalcanal, is shown on this page.
The antenna is five "elements" (half-wave dipoles) wide. Each section is 2 dipoles high. Polarization is horizontal (i.e. The dipoles lie horizontally rather than vertically). The screen is backed with chicken wire type mesh. This equipment has a frequency of 96.5 to 103 Mcs. It is primarily for early warning of aircraft approach and gives range and bearing with a maximum range of 50 to 60 miles for high-flying aircraft. The antenna rotates with the shack to which it is attached but does not elevate. The shack is motor-driven. The screen framework and shack are of wood construction.

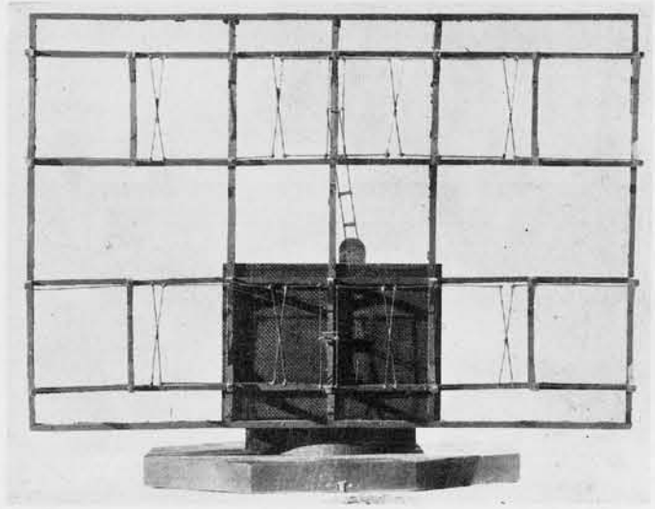


Drawing of Guadalcanal type screen with steel framework, which typifies all later models.

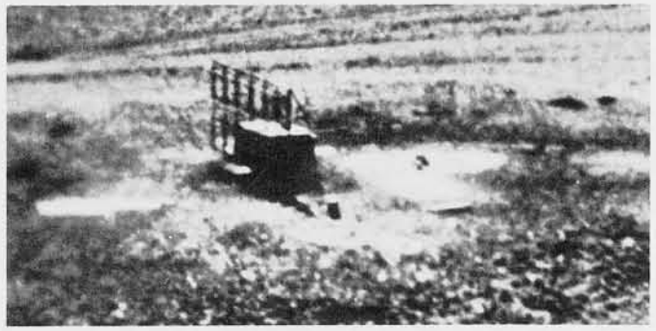
LOCATION	GUADALCANAL
TYPE (MARK I, MODEL I)	"GUADALCANAL"
ANTENNA	26' x 18'
FREQUENCY	100 MCS
P.R.F. 880 - 1200	PULSE 12 - 30
MAXIMUM RANGE	60 N. MI.



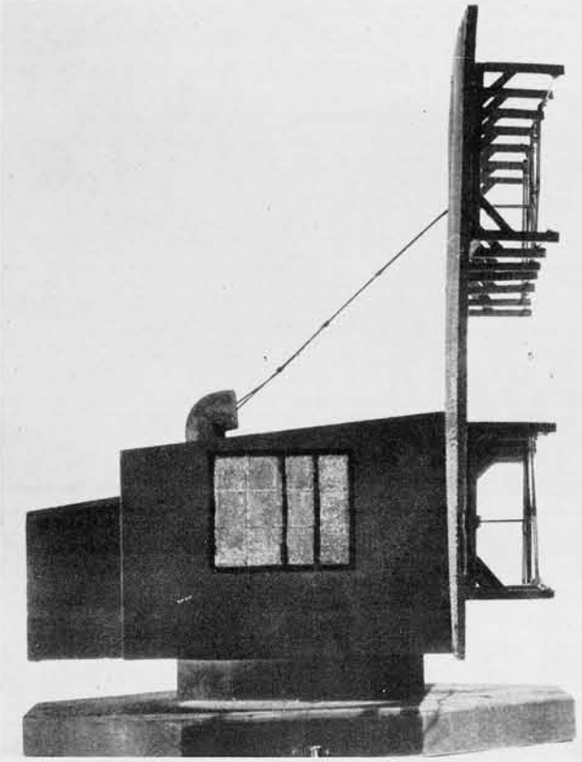
GUADALCANAL, SOLOMONS
ABOVE: Plan view of a scale model. Note small appendage at rear of control shack which is characteristic of Guadalcanal and Attu type radars.



GUADALCANAL, SOLOMONS
ABOVE, front view of scale model showing details of the antenna.



GUADALCANAL, SOLOMONS



GUADALCANAL, SOLOMONS
ABOVE: Side view of scale model showing shed roof which is characteristic of all Guadalcanal types. The screen framework here is of wood. Later models incorporated the use of steel for structural framework.
BELOW: Low obliques taken at Guadalcanal.

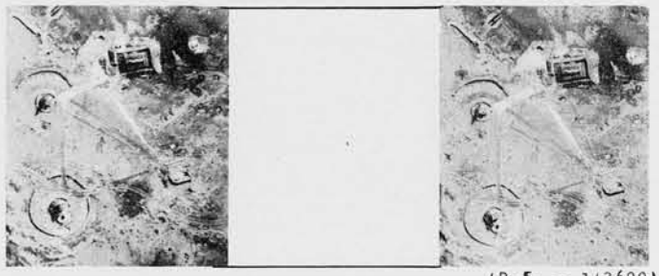
GUADALCANAL, SOLOMONS

RADAR

GUAD. TYPE (CONT.)

KISKA, ALEUTIANS (R.F. - 1 1200)

ABOVE: note strong screen shadows. Generator building not present, power coming from a removed source. Revetment 1 foot high and 32 feet in diameter. Distance between screens is 130 feet.



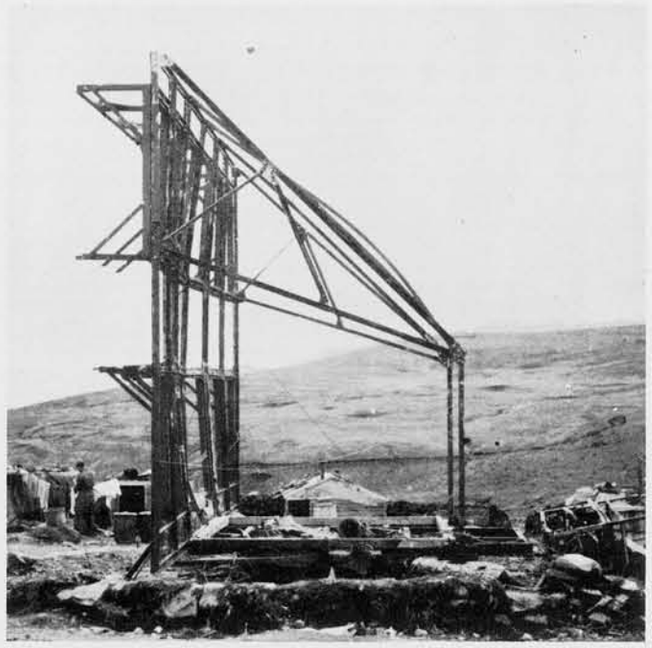
KISKA, ALEUTIANS (R.F. - 1/3600)

The Guadalcanal type radar is now constructed as shown on this page, with a metal screen framework.

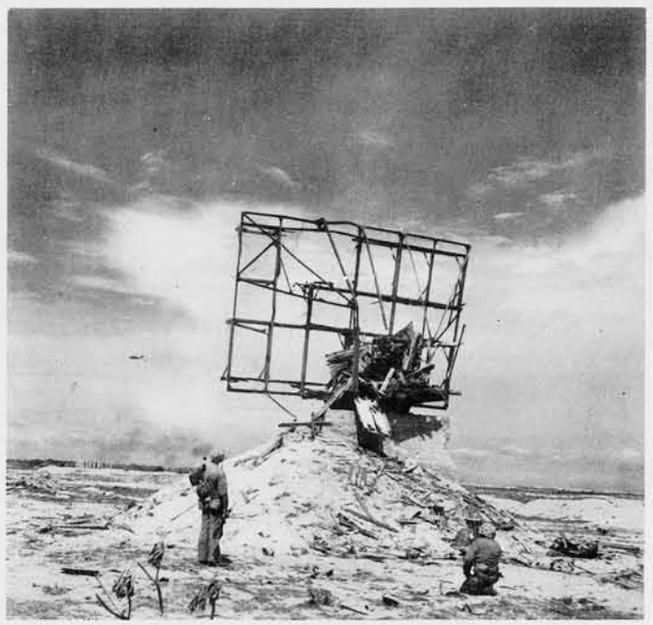
Both localities afford examples of twin installations, where one set may be used for search while the other tracks a specific target.

Screen is 28 feet wide and 18 feet high. Control shack, which rotates with screen, is 10' x 10' with an additional small square projection on side opposite screen.

LOCATION	KISKA
TYPE . . . . (MARK 1, MODEL 1)	"GUADALCANAL"
ANTENNA	26' x 18'
FREQUENCY	100 MCS
P.R.F. 880-1200	PULSE . . 12-30
MAXIMUM RANGE	75 N. MI.



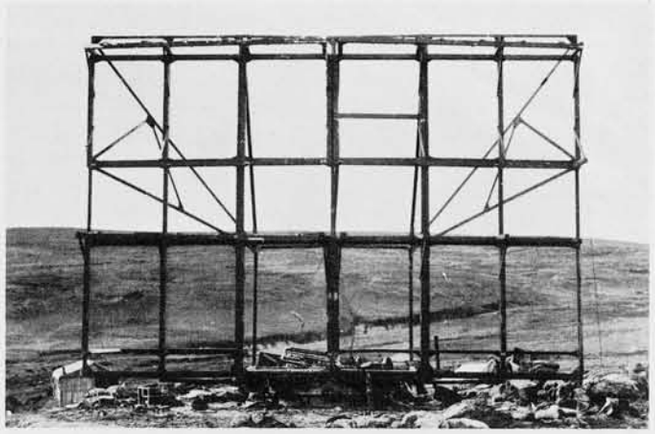
KISKA, ALEUTIANS



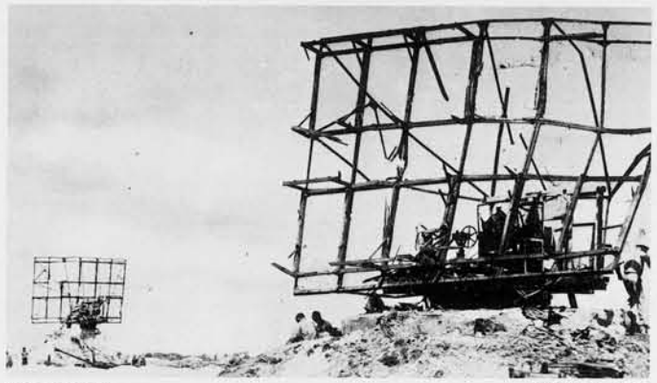
KWAJALEIN, MARSHALLS

ABOVE: note elevated emplacement used on low coral island. This is the same type of radar as seen at Kiska.

KISKA, ALEUTIANS



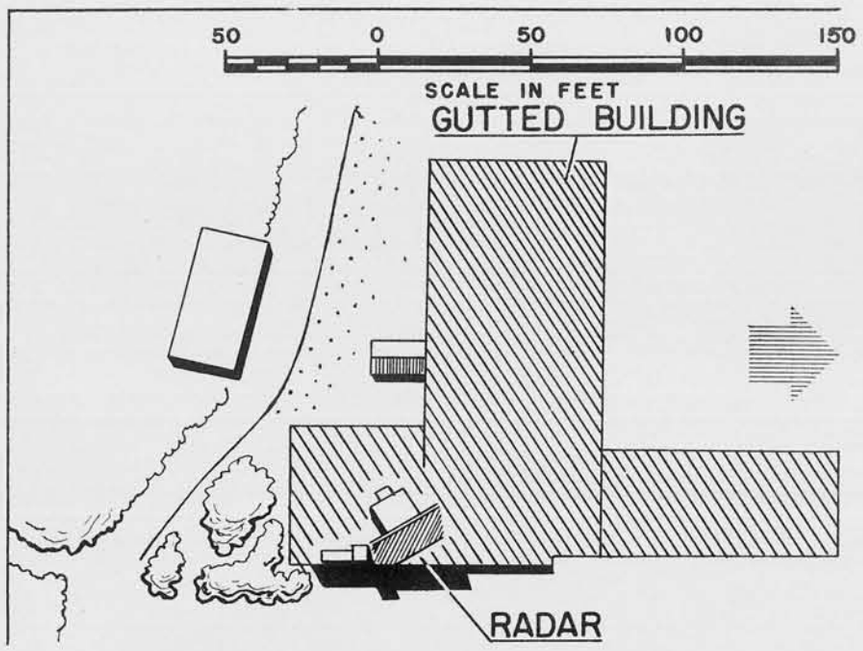
KISKA, ALEUTIANS



LOCATION	KWAJALEIN
TYPE . . . . (MARK 1, MODEL 1)	"GUADALCANAL"
ANTENNA	26' x 18'
FREQUENCY	100 MCS
P.R.F. . . . . 880 - 1200	PULSE . . 12 - 30
MAXIMUM RANGE	75 N. MI.

RADAR

GUAD. TYPE (CONT.)

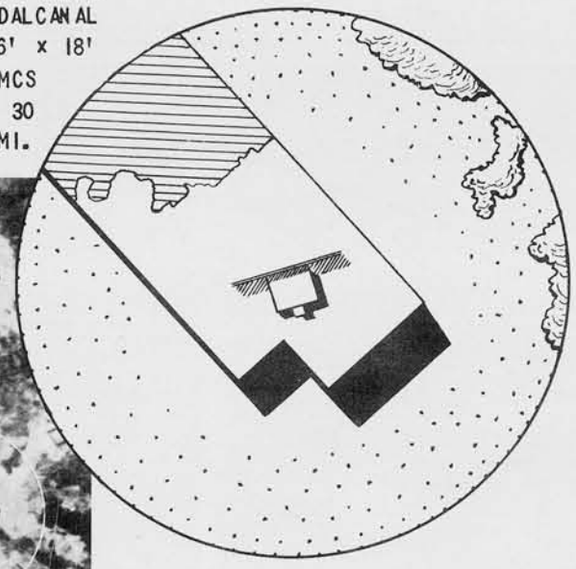


LOCATION . . . . . PEALE I., WAKE
TYPE . . . . . (MARK I, MODEL I) . . . . . GUADALCANAL
ANTENNA . . . . . 26' x 18'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . . . PULSE . . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

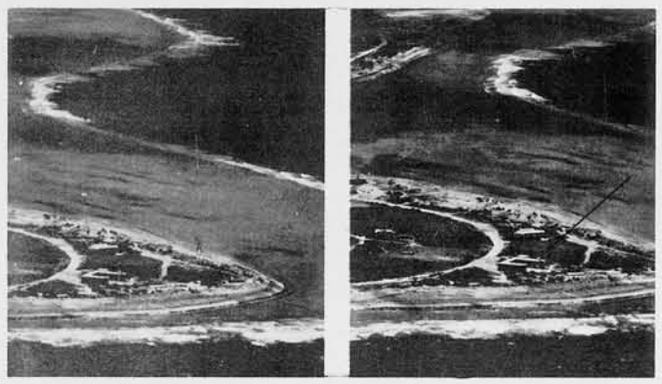
(NO PARALLAX)

PEALE ISLAND, WAKE

HEEL POINT, WAKE



LOCATION . . . . . WOTJE
TYPE . . . . . (MARK I, MODEL I) GUADALCANAL"
ANTENNA . . . . . 26' x 18'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . . . PULSE . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

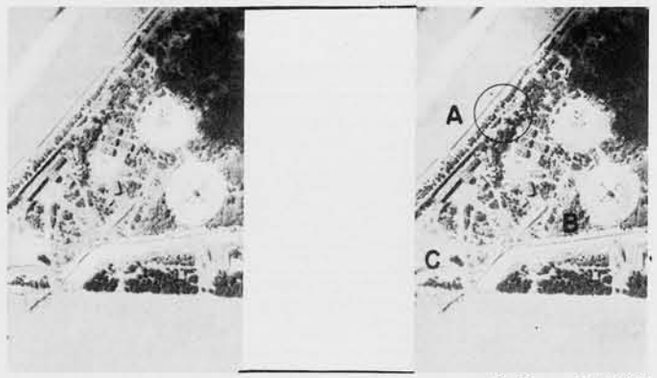


LOCATION . . . . . HEEL PT., WAKE
TYPE . . . . . (MARK I, MODEL I) "GUADALCANAL"
ANTENNA . . . . . 26' x 18'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . . . PULSE . . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

On this page are shown three more localities having Guadalcanal type Radar, similar to those at Kiska and Kwajalein. On coral islands the required height for installation is sometimes obtained by mounting set atop existing buildings. Note particularly the small square appendage on back of control shack.

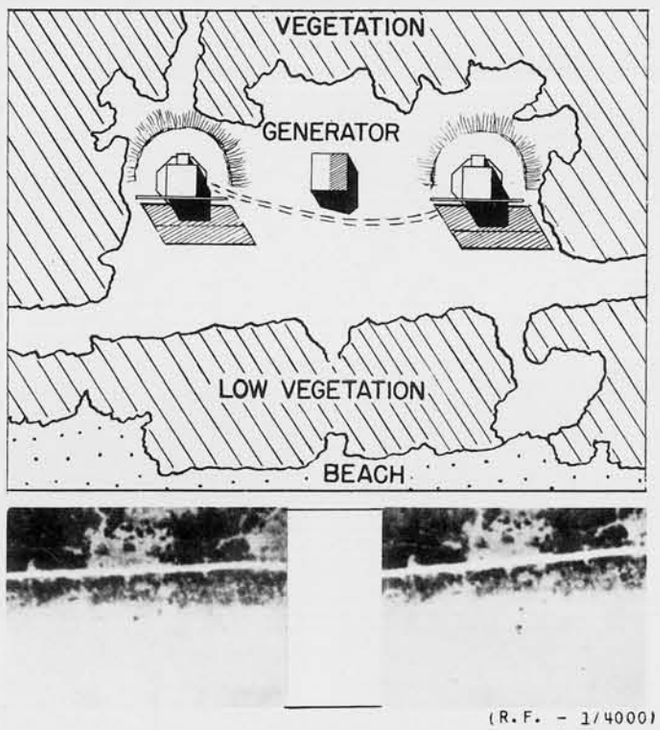
CONFIDENTIAL

RADAR
GUAD. TYPE (CONT.)



(R.F. - 1/9000)

MARCUS

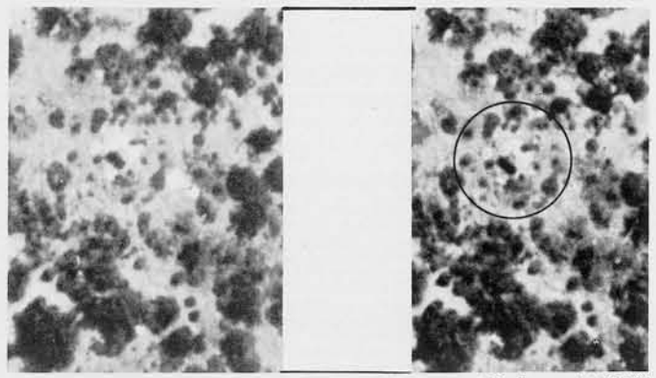


(R.F. - 1/4000)

LOCATION . . . . . MARCUS
TYPE . . . . . (MARK I, MODEL I) . . . . . "GUADALCANAL"
ANTENNA . . . . . 26' x 18'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . PULSE . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

The above twin Radar installation at Marcus is located near the D. F. Station. The generator building is centrally located and is approximately 12 feet square.

In this case, one Radar may be used for search while the other tracks.



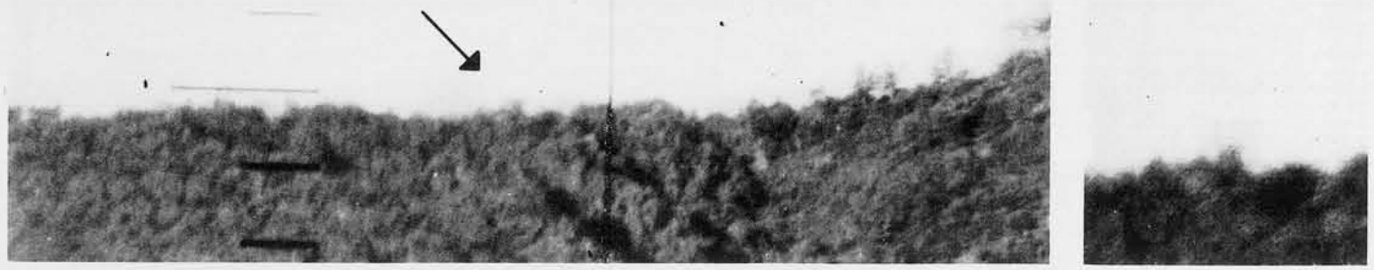
(R.F. - 1/3000)

LOCATION . . . . . NAURU
TYPE . . . . . (MARK I, MODEL I) . . . . . "GUADALCANAL"
ANTENNA . . . . . 26' x 18'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . PULSE . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

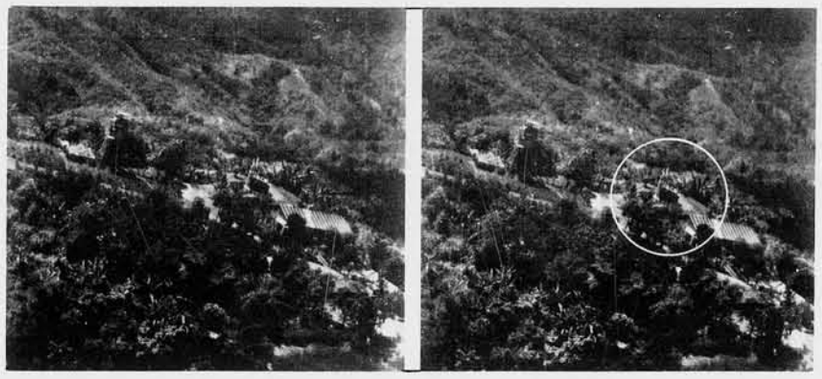
This installation at Nauru was once thought to have had a parabolic screen. However, it is now believed that the equipment functions in a similar manner and at the same frequency as the "Guadalcanal" type.

Previously, this set was shown as an example of a separate type of Japanese Radar, called "Nauru type". However in light of present information it seems more fitting to include it under Guadalcanal type.

This submarine photo of Shikoku, Japan, shows the faint outlines of a screen which is probably the Guadalcanal type radar. Identification cannot usually be based on such meager information, however. (Below)



SHIKOKU, JAPAN



LOCATION . . . . . RABAUL
TYPE . . . . . (MARK I, MODEL I) . . . . . "GUADALCANAL"
ANTENNA . . . . . 26' x 18'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . PULSE . . . . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

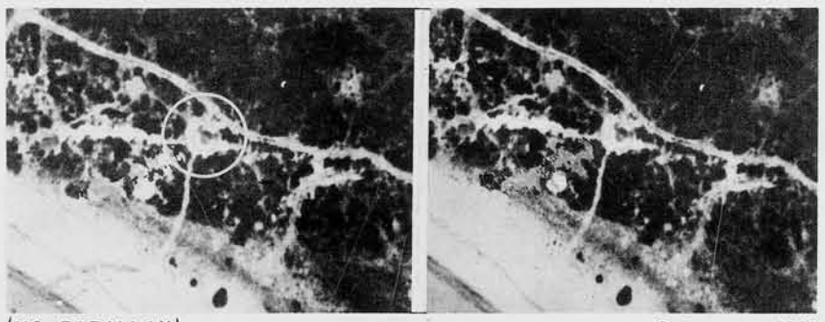
At the present date it is more likely that the Mobile Mattress, Attu, and other new types will be found in greater numbers than the Guadalcanal type.

The Stereo oblique to the left is a remarkably clear example of the "Guadalcanal" type. Note the projection of rows of dipoles from the front of the screen, which is two-dimensional and does not have a box-like character such as may be observed in "Attu" type shown on other pages later in this section. The flat roof on the control shack is characteristic of the Guadalcanal type. Note also that clearing of surrounding vegetation is not necessary for operation of this Radar.

RADAR

GUAD. TYPE (CONT.)

The Kuku Point Radar is apparently a slightly different version of the Guadalcanal type. The bend as shown in the artist's drawing is approximately 25 degrees from a straight line. The low revetment suggests Kiska installations but is much smaller in diameter.



(NO PARALLAX) (R.F. - 1/2800)

LOCATION	KUKU PT., WAKE
TYPE (MARK I, MODEL I)	"GUADALCANAL"
ANTENNA	26' x 18'
FREQUENCY	100 MCS
P.R.F. 880 - 1200 PULSE	12 - 30
MAXIMUM RANGE	75 N. MI.

LOCATION	MALOELAP
TYPE (MARK I, MODEL I)	"GUADALCANAL"
ANTENNA	26' x 18'
FREQUENCY	100 MCS
P.R.F. 880 - 1200 PULSE	12 - 30
MAXIMUM RANGE	75 N. MI.

(R.F. - 1/5000)

LOCATION	MALOELAP
TYPE (MARK I, MODEL I)	"GUADALCANAL"
ANTENNA	26' x 18'
FREQUENCY	100 MCS
P.R.F. 880 - 1200 PULSE	12 - 30
MAXIMUM RANGE	75 N. MI.

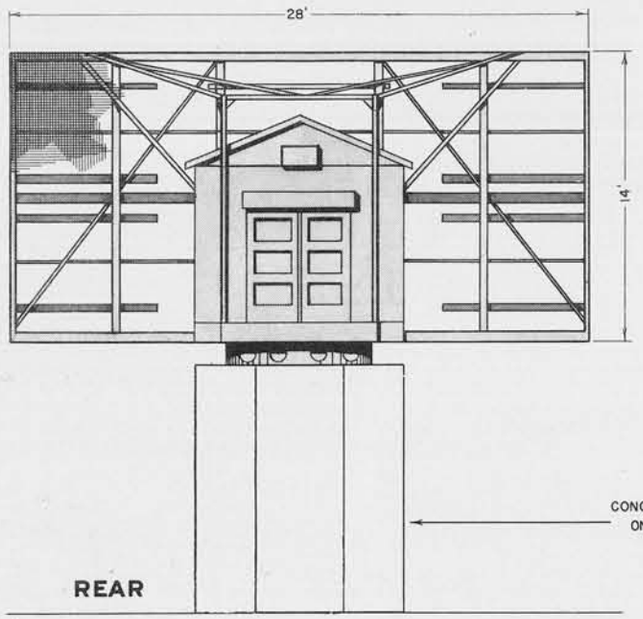
RADAR
ATTU TYPE

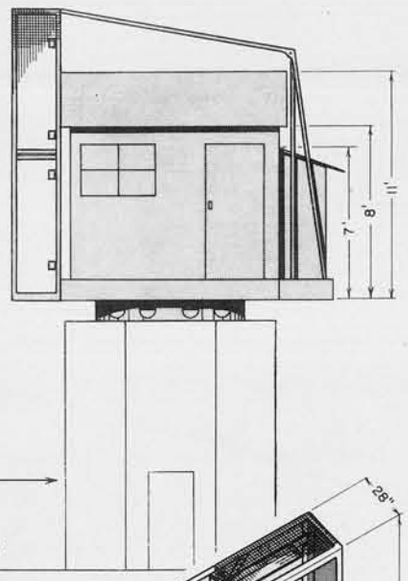
This radar, hereafter called the "Attu" type, was in an unassembled state when first found at Attu, Aleutians.

Electrically, it is very similar to the Guadalcanal type but is, in general, an improved modification. As of November 1944, it is still being used by the Japanese to a considerable extent in all areas.

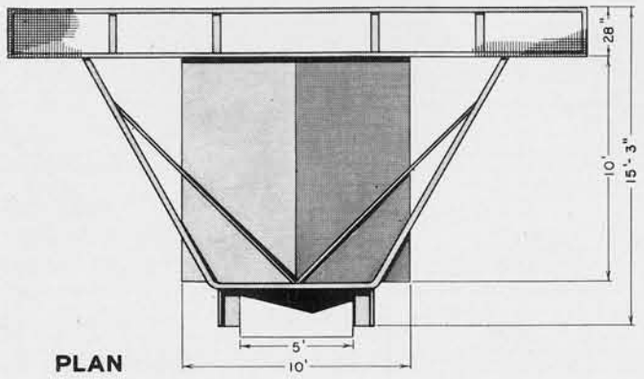
The most important identification factor, the box screen, is not present in these photos. Spotting of radar positions in aerial photos is largely dependent on screens and screen shadows. Below are shown drawings reconstructing the "Attu" type radar, shown on this and several following pages.

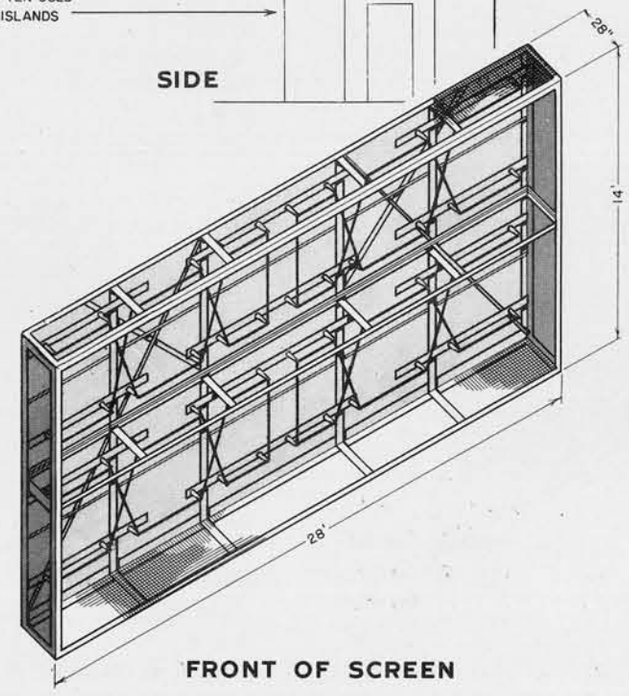
ATTU, ALEUTIANS

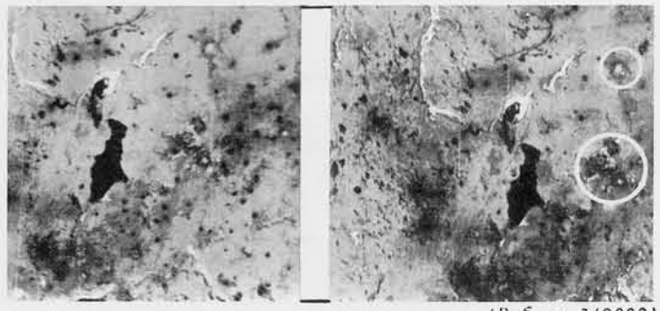




CONCRETE BASE OFTEN USED ON LOW CORAL ISLANDS

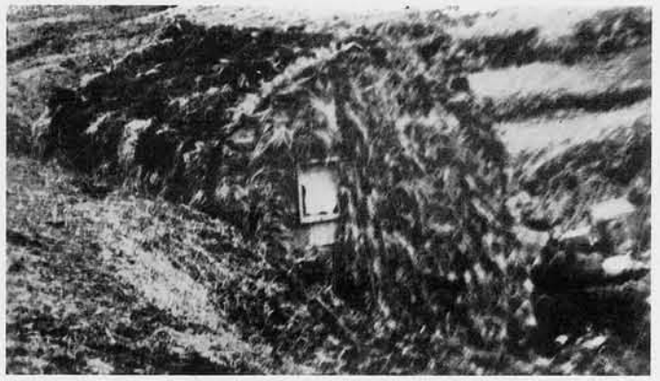






ATTU, ALEUTIANS (R.F. - 1/8000)

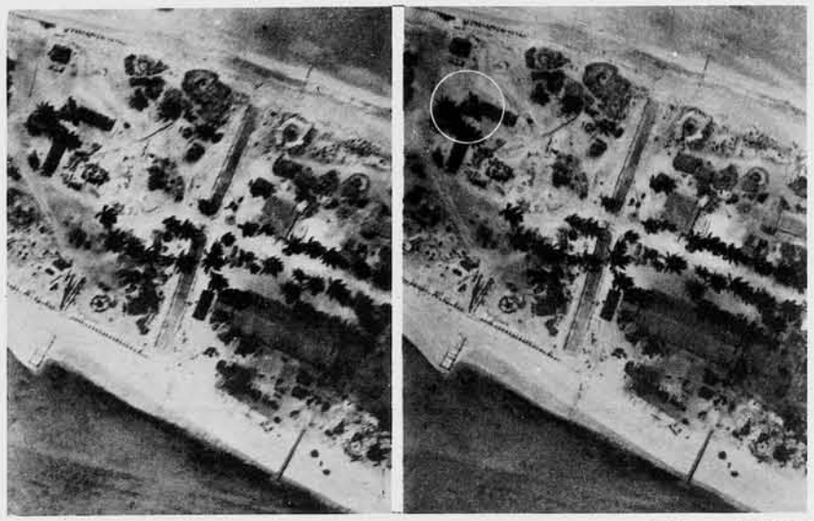
The first example found of the Attu type Radar was still in the process of construction. These views will illustrate the extreme difficulty of spotting radar without its best identifying characteristic -- the screen. Shown below is a well camouflaged generator house, also very difficult to detect in aerial photos.



LOCATION	ATTU
TYPE. (MARK I, MODEL I, MODIF. I)	"ATTU"
ANTENNA	28' x 14' x 2 1/3'
FREQUENCY	100 MCS
P.R.F.	.880 - 1200 . . . PULSE . . . 12 - 30
MAXIMUM RANGE	75 N. MI.

CONFIDENTIAL

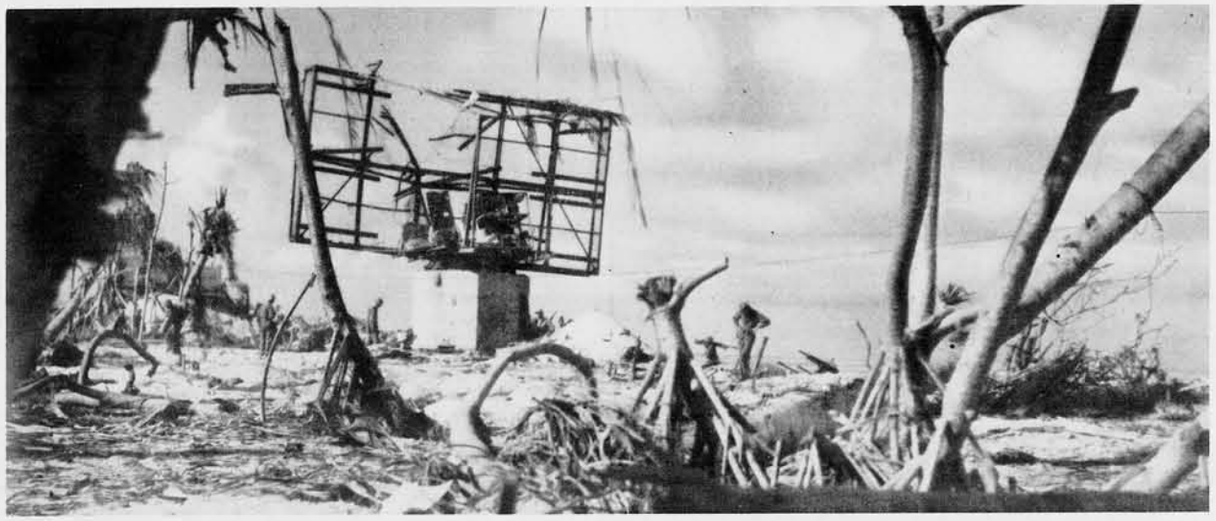
RADAR
ATTU TYPE (CONT.)



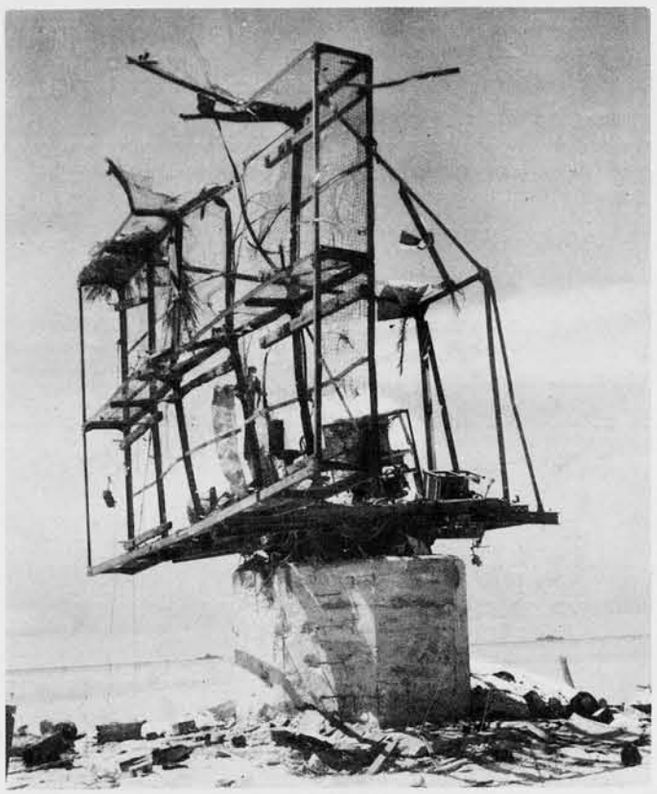
(R.F. - 1/2000)

TARAWA, GILBERTS

ABOVE: Radar near east tip of Bititu

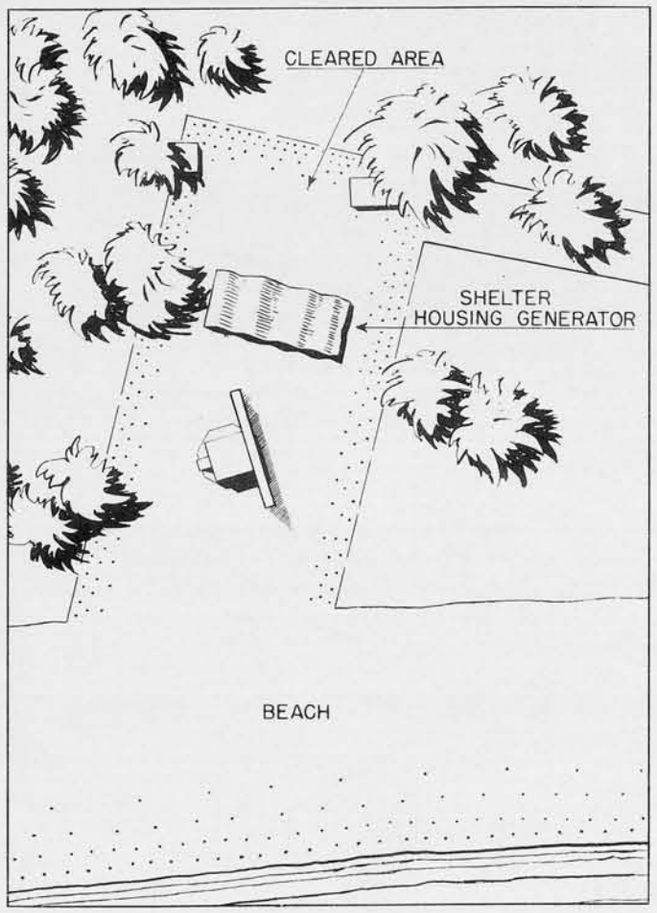


TARAWA, GILBERTS



TARAWA, GILBERTS

ABOVE: Note the horizontally elongated box-like shape of the screen of the ATTU type in contrast to the two dimensional more squared shape of the Guadalcanal type on previous pages.



TARAWA, GILBERTS

TARAWA, GILBERTS

ABOVE: Radar on west end of Bititu.

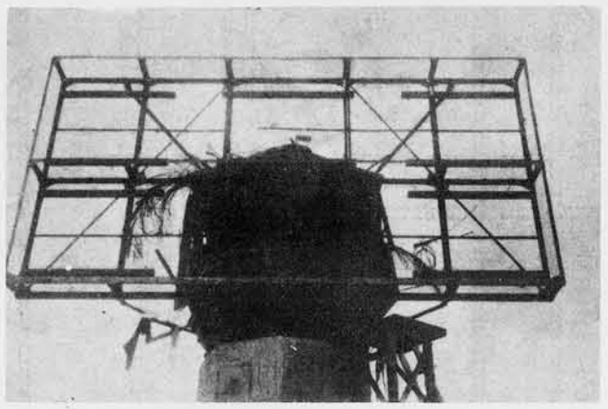
At Bititu Island, Tarawa Atoll were two Attu type radars of identical design. One was at the west end and the other a few hundred feet from the east tip. Both were set on high concrete bases and were used for different sectors of the air and surface search.

LOCATION	TARAWA
TYPE. (MARK I, MODEL I, MODIF. I)	"ATTU"
ANTENNA	28' x 14' x 2 1/3'
FREQUENCY	100 MCS
P.R.F. 880 - 1200 PULSE	12 - 30
MAXIMUM RANGE	75 N. MI.

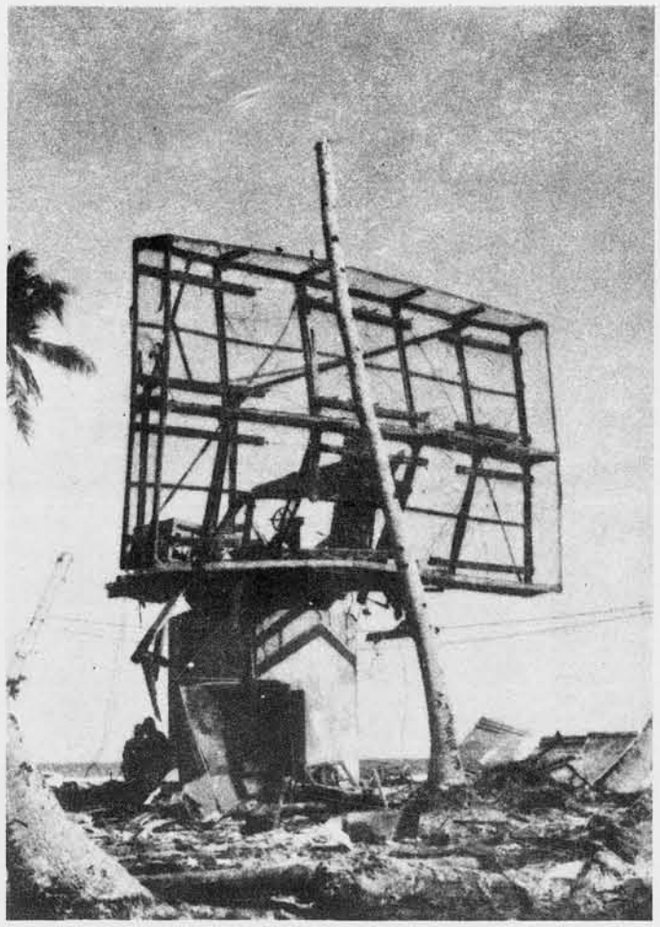
RADAR
ATTU TYPE (CONT.)

MAKIN, GILBERTS

ABOVE AND BELOW: Two views of Radar at end of Stone Pier. Concrete base is 18 feet high. Note pitched roof of "Attu" type.



MAKIN, GILBERTS



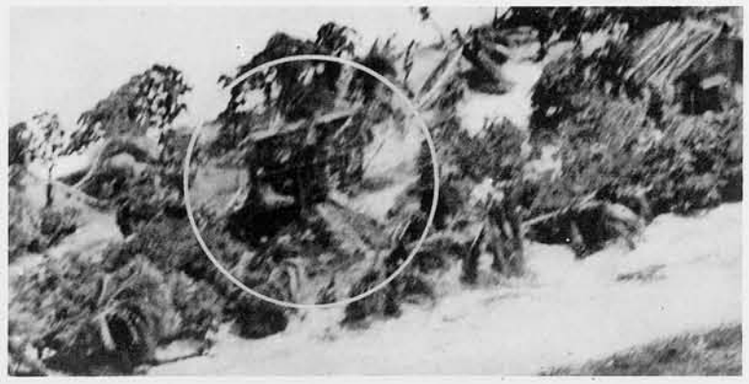
MAKIN, GILBERTS

ABOVE: Radar on South Coast. Concrete base is 8 feet high.

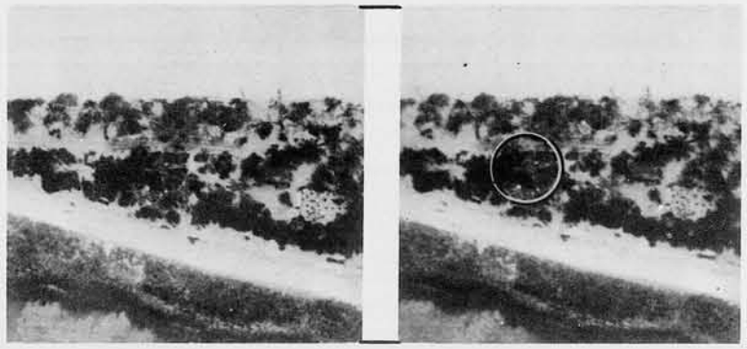
The two Radar installations on Makin are of the same design as at Tarawa and were installed in October 1943. The control shacks rotate with the screens on steel turntables to afford complete search coverage.

The high concrete bases afford greater range for surface search.

LOCATION	MAKIN
TYPE. (MK. I, MODEL I, MODIF. I)	"ATTU"
ANTENNA	28' x 14' x 2 1/3'
FREQUENCY	100 MCS
P.R.F.	880 - 1200 PULSE 12 - 30
MAXIMUM RANGE	75 N. MI.

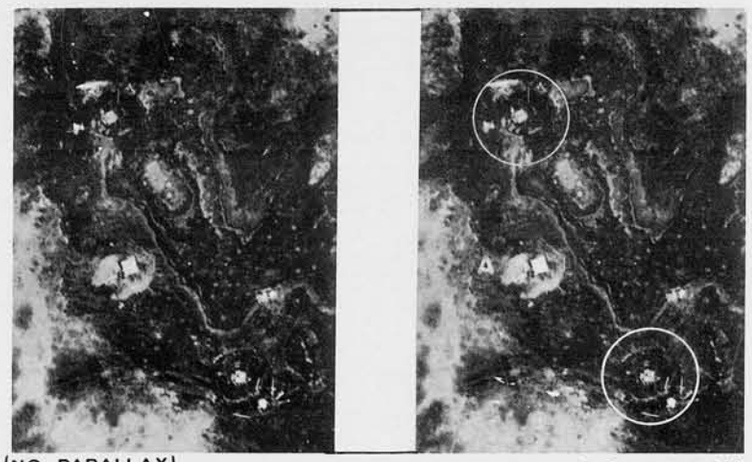


MILLE, MARSHALLS



MILLE, MARSHALLS

Same Radar on Mille, now cleared of vegetative camouflage.



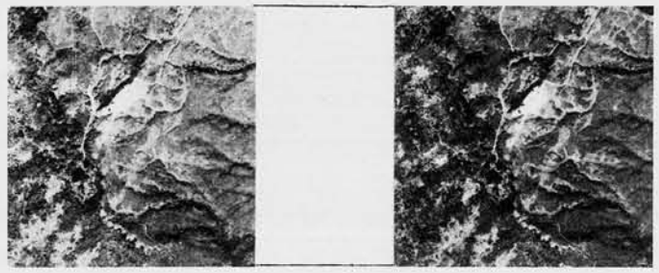
(NO PARALLAX) (R.F. - 1/35001)

KAKUMABETSU WAN, PARAMUSHIRO

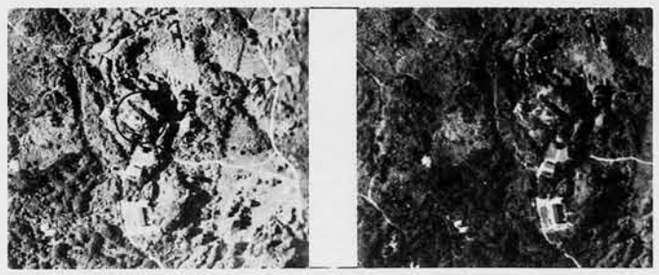
LOCATION	MILLE & PARAMUSHIRO
TYPE. . .(MK. I, MODEL I, MODIF. I)	"ATTU"
ANTENNA	28' x 14' x 2 1/3'
FREQUENCY	100 MCS
P.R.F.	880 - 1200 PULSE 12 - 30
MAXIMUM RANGE	75 N. MI.

RADAR
ATTU TYPE (CONT.)

Numbers 1, 2, 3, 4, 5, and 6 on this page show the "Attu" type Radar at various scales for analytical study and comparison. The "Attu" type is widely used by the Japanese at present and its outward appearance in vertical photography is familiar to many interpreters. Although no information is available on the use of German equipment by the Japanese, a Small Wurzburg is shown here for further comparison in #4: "A"-Attu; "B"-Wurzburg.



LOCATION . . . . . IWO JIMA
TYPE. (MK I, MODEL I, MODIF. I) . . . . . "ATTU"
ANTENNA . . . . . 28' x 14' x 2 1/3'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . PULSE . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

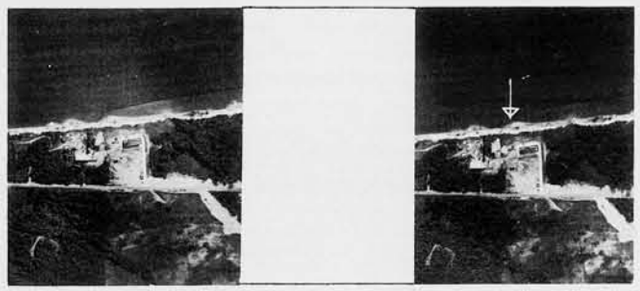


LOCATION . . . . . OKAYAMA, FORMOSA
TYPE. (MK. I, MODEL I, MODIF. I) . . . . . "ATTU"
ANTENNA . . . . . 28' x 14' x 2 1/3'
FREQUENCY . . . . . 100 MCS
P.R.F. . . . . 880 - 1200 . . . . . PULSE . . . . 12 - 30
MAXIMUM RANGE . . . . . 75 N. MI.

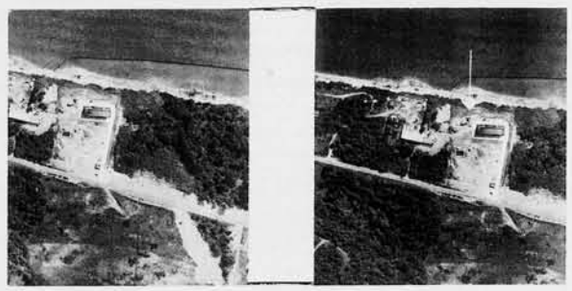
ABOVE: These two examples in the Kazans and on Formosa appear to be "Attu" type installations:

In both examples other related activities, such as communications, generating of power, and living and working quarters are present.

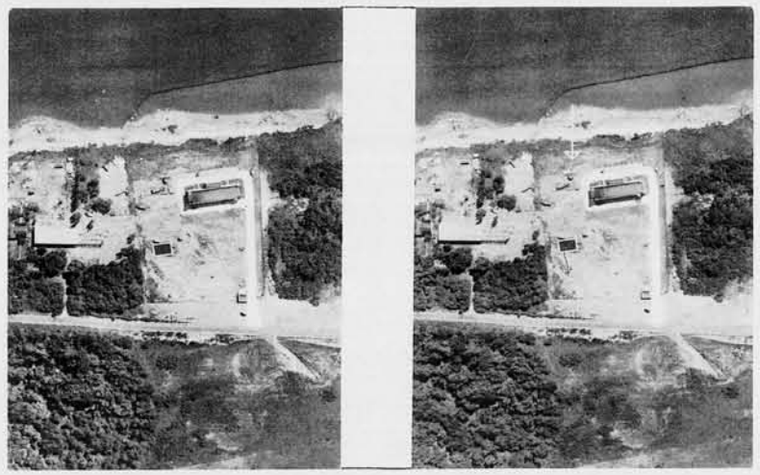
The Okayama set is 10 miles inland from the coast and both are situated on high points of land.



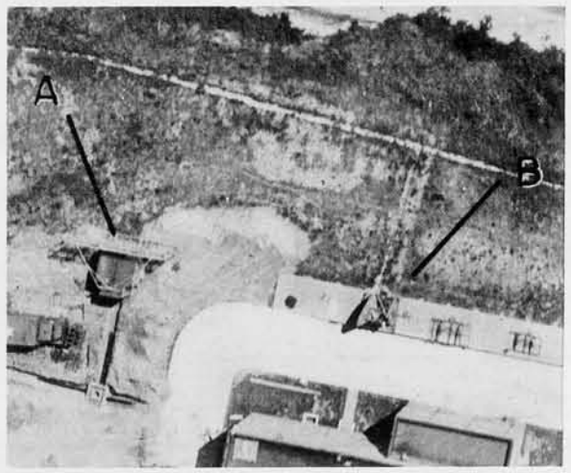
1 (R.F. - 1/15000)



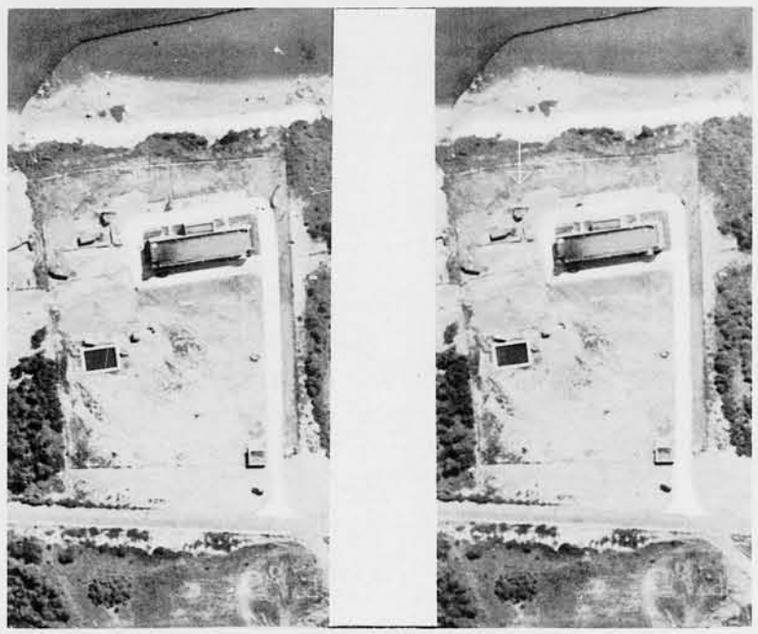
2 (R.F. - 1/10000)



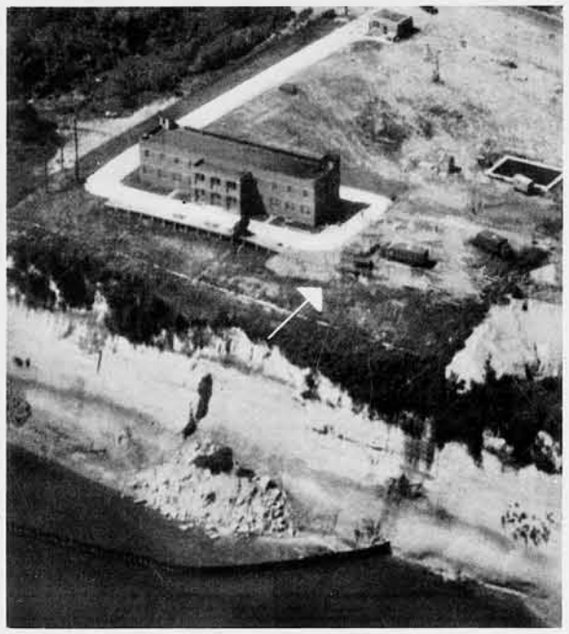
3 (R.F. - 1/5000



4 (R.F. - 1/1000)



5 (R.F. - 1/2600)



6 12" OBLIQUE AT 1000'

CONFIDENTIAL

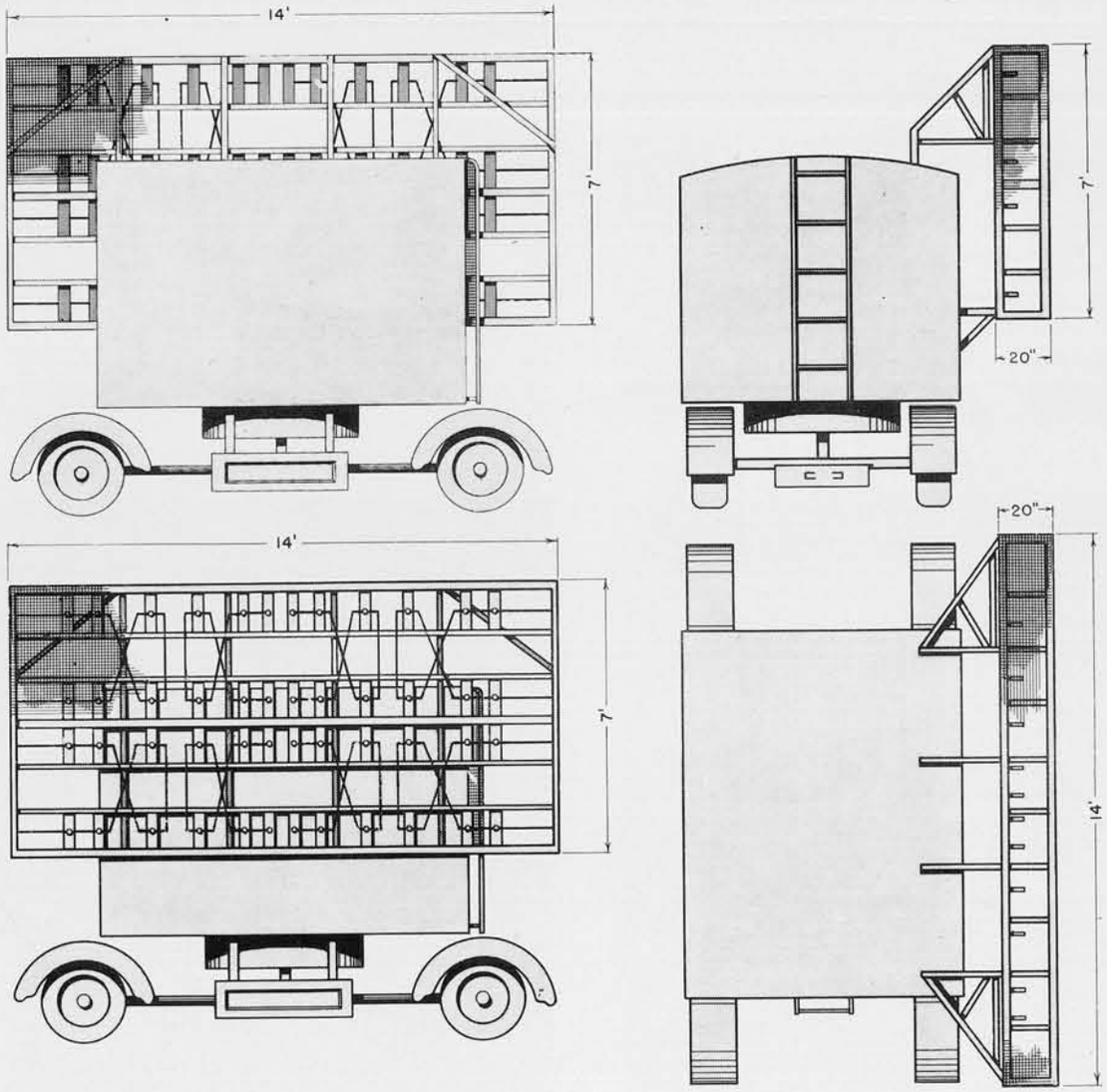
RADAR
MOBILE MATTRESS

A later, and apparently more efficient, Radar type is the "Mobile Mattress" or "Mark I, Model II". The Radar operates at 200 mcs. and is identified by a small screen (14' x7') mounted on a Japanese standard army trailer (type 94).

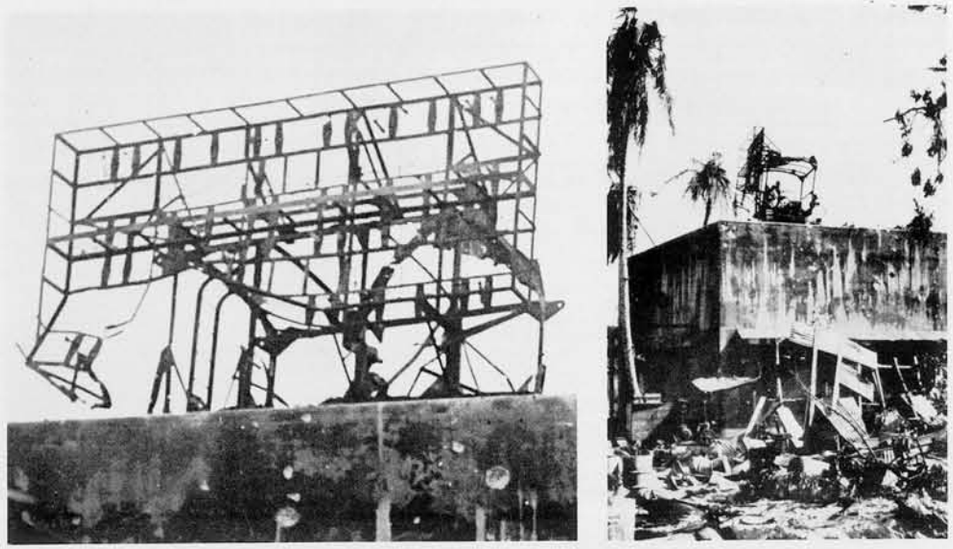
This Radar is being used more and more for land-based search, either alone or in conjunction with older types. It is frequently seen mounted in emplacements, suggestive of a permanent siting.

Below are reconstructed drawings made from photos of the Kwajalein set.

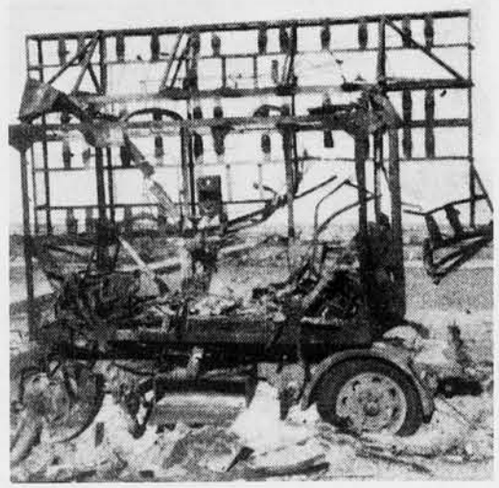
The shack, antennae, revolving mount and trailer may be separated for shipping purposes.

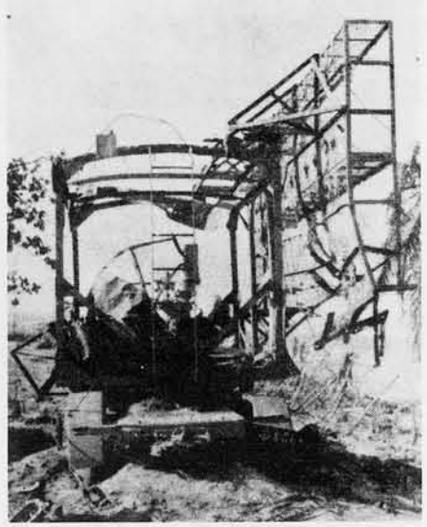


SHACK AND SCREEN ROTATE ON TURNTABLE



NAMUR, KWAJALEIN, MARSHALLS





NAMUR, KWAJALEIN, MARSHALLS

LOCATION	KWAJALEIN
TYPE (MK. I, MODEL 2)	"MOBILE MATTRESS"
ANTENNA	14' x 7' x 1 2/3'
FREQUENCY	200 MCS
P.R.F. 800 - 1500 ... PULSE	3 1/2 - 12
MAXIMUM RANGE	100 N. MI.

The Mobile Mattress captured at Namur, Kwajalein, was mounted atop the standard concrete power house. Although the set is badly damaged, it is still possible to establish the important recognition features.

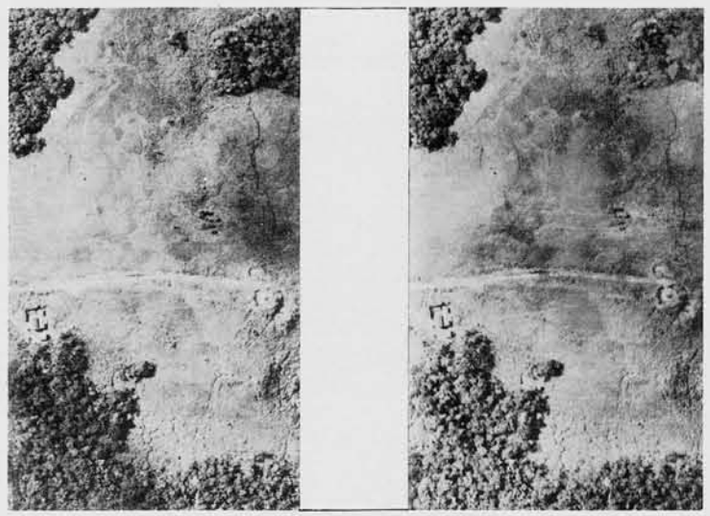
Note the similarity in design between this and the Attu type screen. The Mobile screen is much smaller, however.

RADAR

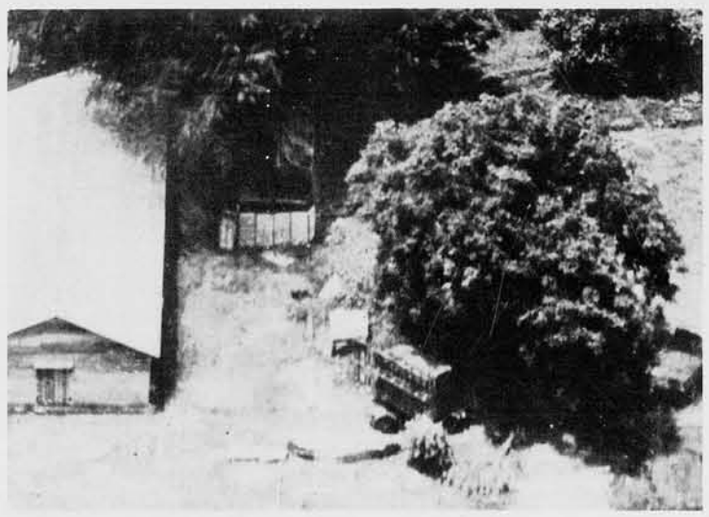
MOBILE MATTRESS (CONT.)

Several additional views of the "Mobile Mattress" or Mark 1, Model 2 are shown for familiarization. This set is very probably the best Japanese Search Radar in general use at present. The frequency is 200 megacycles per second and the maximum range is 100 nautical miles.

SATAWAN, CAROLINES

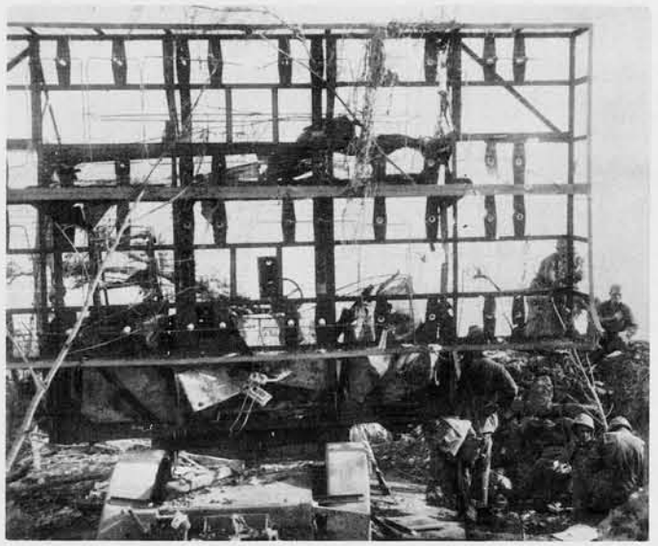


PONAPE, CAROLINES (R.F. - 1/14750)



RABAUL, NEW BRITAIN

TINIAN, MARIANAS



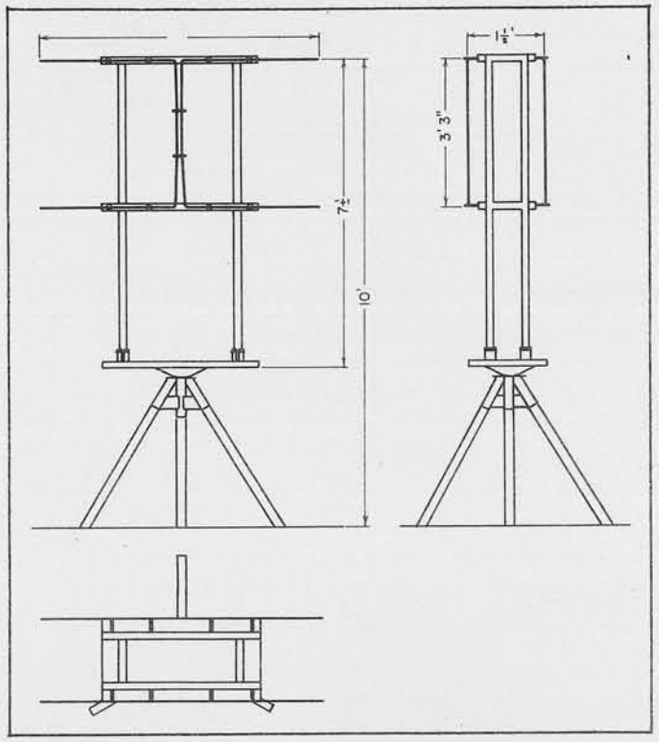
TINIAN, MARIANAS

TINIAN, MARIANAS

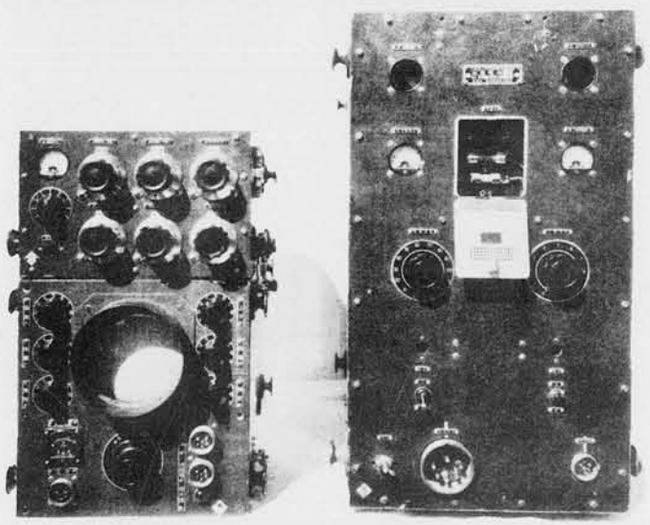
TINIAN, MARIANAS

RADAR
PORTABLE TYPES

LOCATION . . . . . PORTABLE
TYPE . . (AIR MK 6 "SPECIAL") . . . "MARK 6 PORTABLE"
ANTENNA . . . . . DIPOLES
FREQUENCY . . . . . 150 MCS
P.R.F. . . . . 1000 . . PULSE 3-5
MAXIMUM RANGE . . . . . .30 N. MI.



MARK 6 PORTABLE

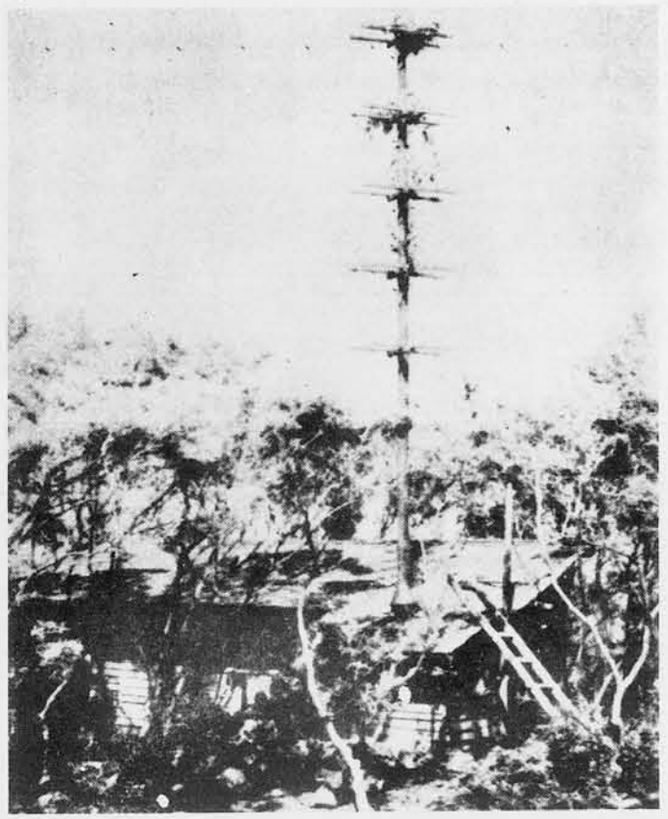


MARK 6 MODEL 4 EQUIPMENT

MARK 6 PORTABLE

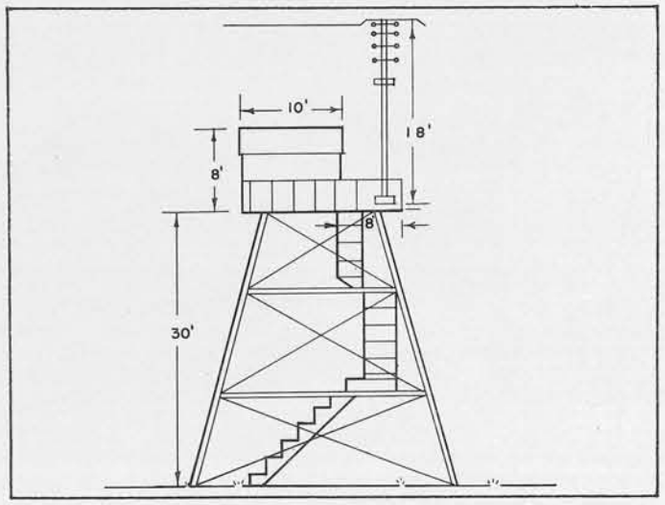
ABOVE AND LEFT COLUMN: This portable Radar ("Mark 6 Portable") is an adaptation of the same set used in aircraft for search (Mark 6, Model 4), and its characteristics are believed to be similar to the original airborne model. When in operation, the Radar gear, shown at lower left, rests on the lower shelf and the whole is supported by a collapsible tripod. The dipoles are approximately 7 feet long. This set was found on Guam.

RIGHT COLUMN: The "Mark 13 Portable", (temporary designation Mark 1, Model 3) is believed to be essentially the same set as the "Mark 6 Portable" with certain modifications including higher power and greater range. The mode of construction at the site may vary considerable with this Radar. The above ground shot shows improvised antenna at Saipan. At Goerango Point, Moratai, the antenna, all equipment and control shack were mounted on a tower 30 feet in height. Note that in both cases, however, the antenna consists of a stack of dipoles.



MARK 13 PORTABLE

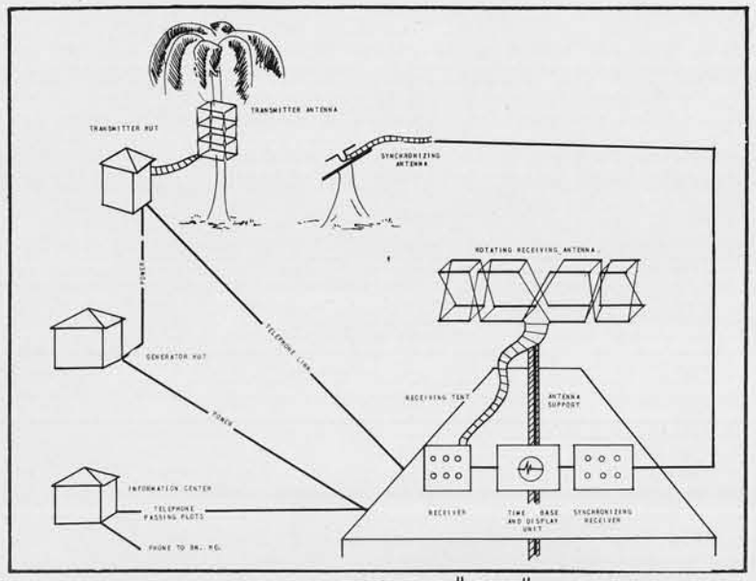
LOCATION . . . . . PORTABLE
TYPE . . . (MK 1, MODEL 3) . . . . . "MK 13 PORTABLE"
ANTENNA . . . . . 7' DIPOLES
FREQUENCY . . . . . 150 MCS
P.R.F. . . . . 500 . . . . PULSE 10
MAXIMUM RANGE . . . . . 45 N. MI.



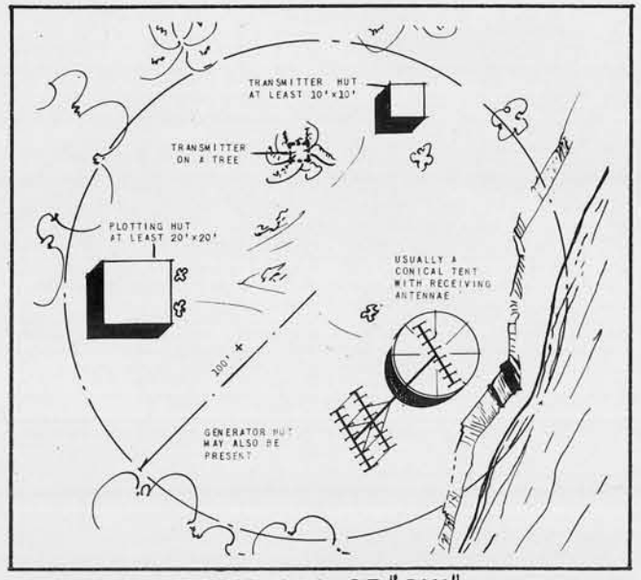
MARK 13 PORTABLE

CONFIDENTIAL

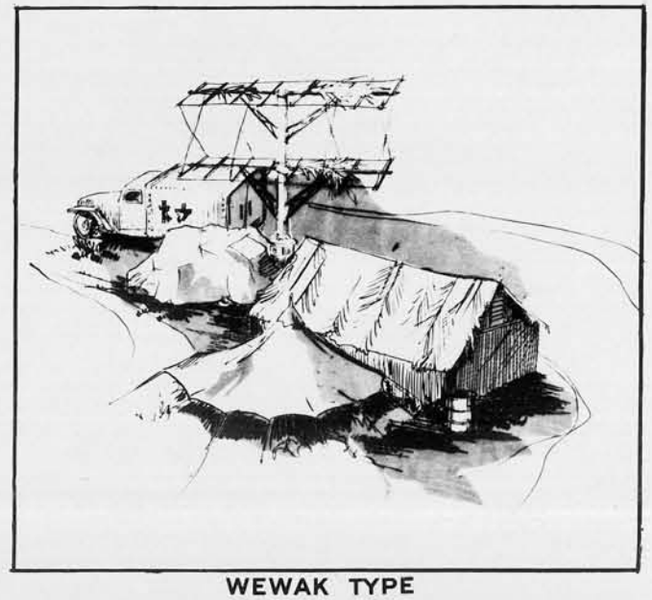
RADAR
PORTABLE TYPES



MARK 229 OR "CHI"



MARK 229 OR "CHI"



WEWAK TYPE

WEWAK TYPE

WEWAK TYPE

Information on the exact designations, characteristics and use of the 70 megacycle Radars are not entirely clear at this time. However, they may be reasonably broken down into two main subdivisions:

(1) A transportable (possibly mobile) type which was first seen at Wewak in 1943 and which has been called the "Wewak" type or "Ya".

(2) A type which may be transportable but entails the use of a separated small non-directional transmitter which is fixed (often attached to the trunk of a tree under the foliage). This type is known as "Chi" or Mark 229.

TYPE	("YA")		"WEWAK"
ANTENNA			20' x 7' x 4'
FREQUENCY			70 MCS
P.R.F.	750	PULSE	25 - 35
MAXIMUM RANGE			125 N. MI.

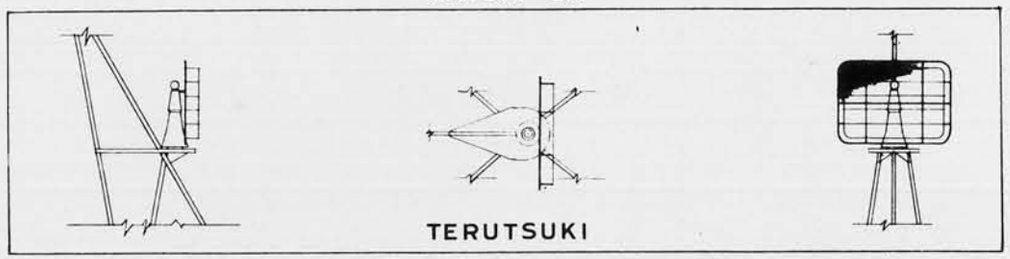
The best recognition feature for the 70 megacycle Radars is the 20' array set on top of a pole. Rough dimensions are as follows: Overall length of row of dipoles - 20'; length of dipoles - 7'; vertical separation between rows of dipoles - 7'; overall height above ground - 25'. The entire shaft and dipoles rotate.

This equipment has the greatest range of most known Japanese Radars now in production and undoubtedly enjoys wide useage in certain areas for early warning purposes. It possesses the advantages of being transportable and is easily camouflaged.

TYPE	(MK 229)		"CHI"
ANTENNA			20' x 7½' x
FREQUENCY			70 MCS
P.R.F.	750	PULSE	25 - 35
MAXIMUM RANGE			125 N. MI.

RADAR
SHIP BORNE TYPES

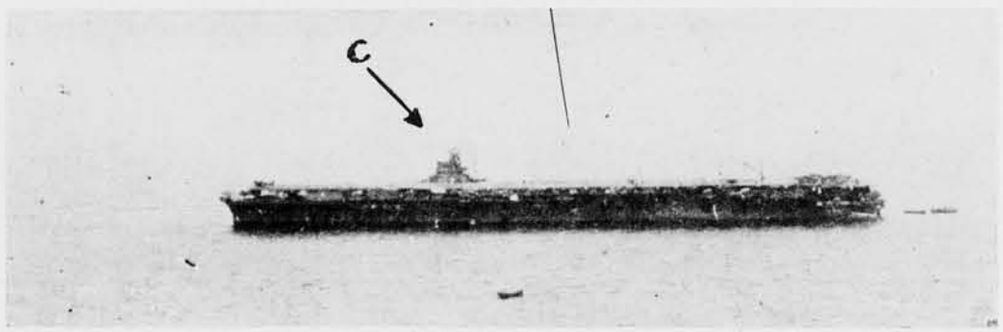
NATCHI CA



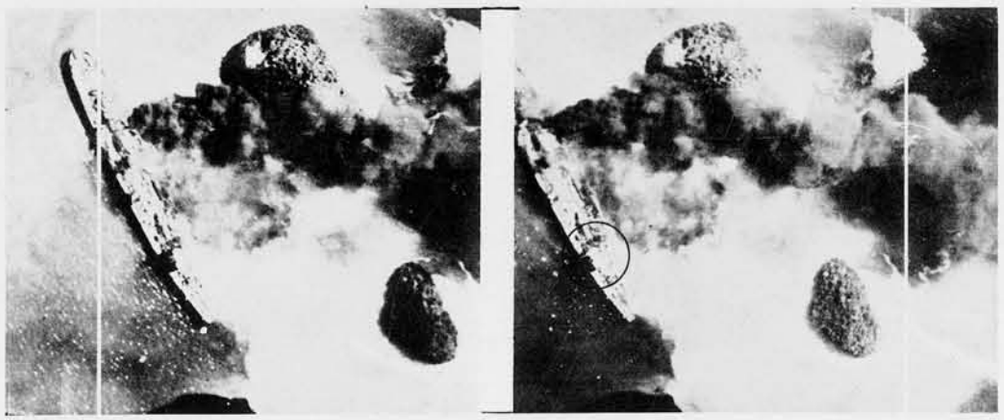
SIDE PLAN FRONT

TERUTSUKI

TERUTSUKI DD



SHOKAKU CV



NAVAL TENDER

There are two basic Radar types in use by the Japanese Navy afloat at the present time. One is a 200 Mcs. search Radar with a mattress type antenna, the other is a 3000 Mcs. Radar for surface search and surface fire control, using electromagnetic horns. (A 150 mcs. Search Radar has been reported)

Search Radar has been photographed many times on Japanese naval vessels and is usually located at the highest point of the ship, except on aircraft carriers, where there are two sets. This search Radar is Mark 2, Model I or "Ship Mattress" and is designed primarily for early warning against planes.

LOCATION	SHIPBORNE
TYPE . . . (MOST ARE MARK 2, MODEL I)	"SHIP MATTRESS"
ANTENNA	14' x 7' x 1.67'
FREQUENCY	200 MCS
P.R.F. . . . . 1000 . . . . . PULSE	10
MAXIMUM RANGE	100 N. MI.

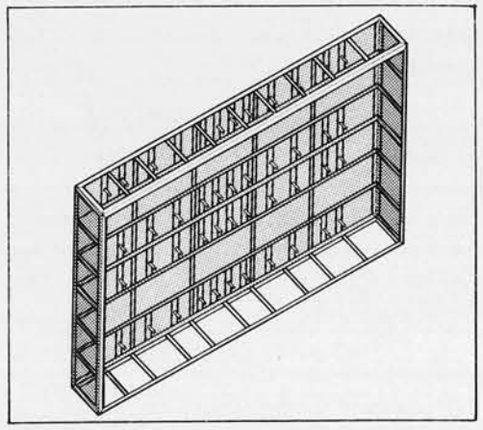
TAIHO CV

"A" - Two Mark 2, Model I antennae, one mounted foreward and the other abaft the island of the CV "Taiho", new Japanese carrier.

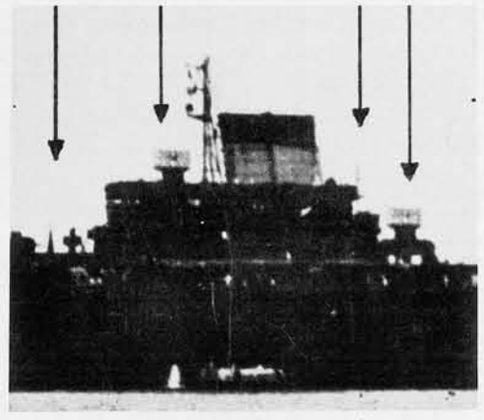
"B" - Two Medium Frequency Loop Type Direction Finders.

"C" - Mark 2, Model I antenna mounted on top of the island superstructure of the CV Shokaku. (See left)

The "Ship Mattress" or Mark 2, Model I antenna (see drawing below) is thought to be almost identical to that of the "Mobile Mattress", a land based Radar. This type is believed to be the most widely used, at present, for shipborne air warning equipment.



SHIP MATTRESS ANTENNA



CV TAIHO, DETAIL OF ISLAND

RADAR
SHIP BORNE TYPES

Drawings of the Electromagnetic horn antennae of the Mark 2, Model 2 Radar are shown on this page.
The Japanese have met with many difficulties in the early development of this "micro-wave" set. Nevertheless, it is now believed to be functioning in a satisfactory manner. P.O.W.'s have reported that it is now used widely throughout the fleet with good results. In that the information on which these drawings were based (lower right) is now over a year old, changes in appearance are quite possible.

However, the configuration will undoubtedly consist of horns similar to the drawings shown on this page. The horn dimensions and the design of the turntable may vary somewhat.

Excerpt from a captured Japanese notebook, probably written from class lecture early in 1944, presents the Japanese problem in Naval Radar. The lecturer is discussing the use and development of Mark 2 Model 1, "Ship Mattress" Radar.

"However it was immediately apparent that it would be difficult to use the set for fire control since this would require range and bearing accuracy beyond the scope of a set designed primarily as a warning device. Nevertheless, the exigencies of war demanded that this set be used for other purposes than those of a mere warning device. Since the set was to be used for fire control, the improvement of range and bearing accuracy was given top priority and the present supplementary equipment was placed in trial production. With the addition of this equipment, the expected results were obtained, but though its sensitivity was enough for a set designed primarily as a warning device, it was still not accurate enough for effective fire control making fullest use of measurement data. It is hoped that great improvements in performance may be expected with the early production of radar designed solely for fire control. (ED: Probably Mk. 2, Model 2, Modif. 12)

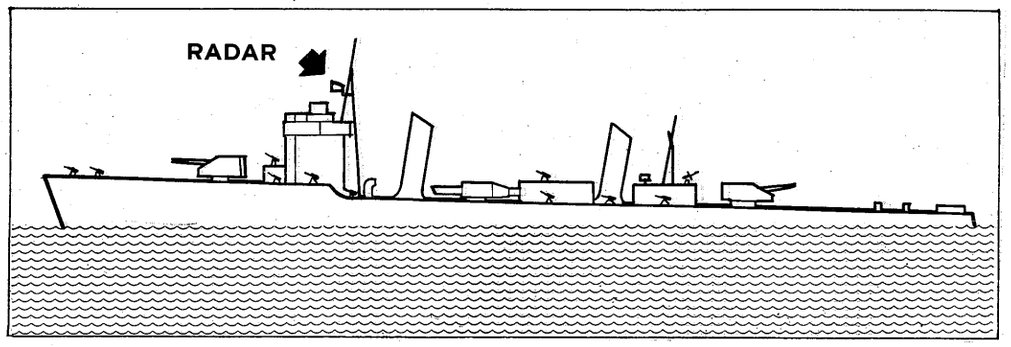
But in the present stage of the war we must get the most out of our present equipment, and not vainly discuss the possibilities for the future. Various methods of dealing with this problem are now under study."

Recent P.O.W. information indicates that many types of Naval Vessels are now equipped with Mark 2, Model 2 and modifications. Knowledge of the present status and performance of the equipment is still somewhat hazy, but interpreters should examine all ships for presence of electro-magnetic horns.

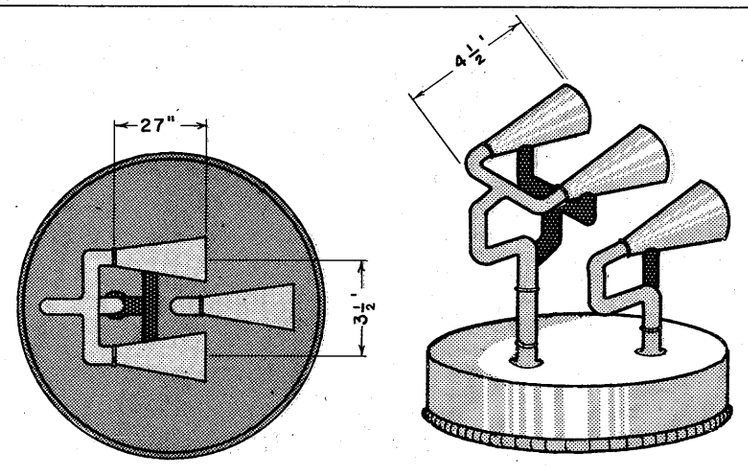
In most vessels, the likely location for the horns is near the top of the foremast or foreward superstructure. On aircraft carriers, they will be high on the island and on subs, close to the conning tower.

It should be kept in mind that Mark 2, Model 2, with modifications or attachments, may be used either for surface search or surface fire control. It is believed that the fire control function requires three horns. The Mark 2, Model 2 set is known as a "micro-wave" Radar, designed for sensitive readings and accurate plotting of surface craft and not for great range.

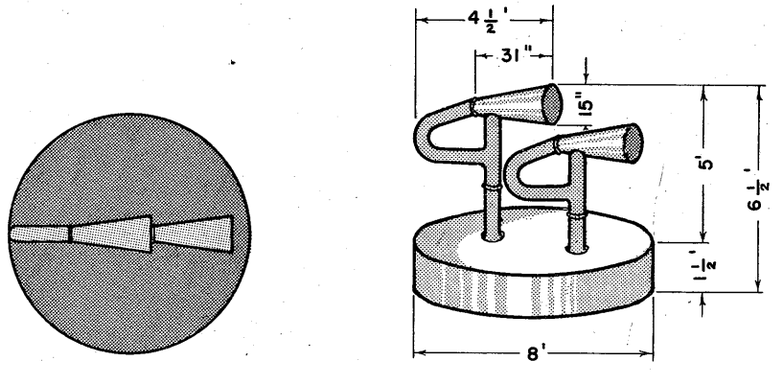
All information on this page is taken from P.O.W. and captured document sources.



MATSU CLASS DD



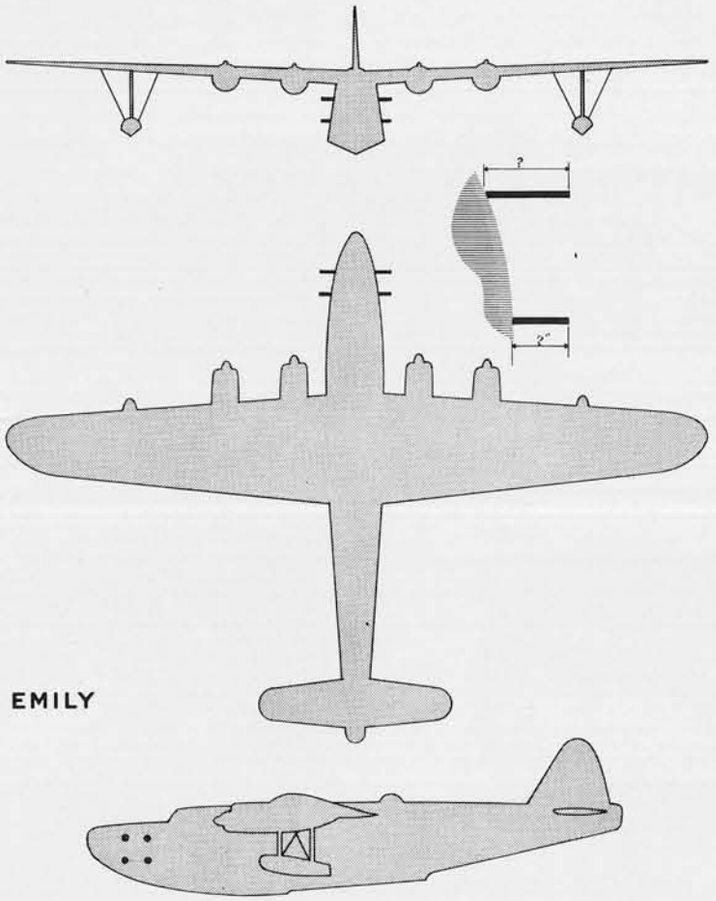
MARK 2, MODEL 2, MODIFICATION 2



MARK 2, MODEL 2

LOCATION	SHIPBORNE
TYPE (MK. 2, MODEL 2 & MODIFICATIONS)	"HORN TYPES"
ANTENNA	ELECTROMAGNETIC HORNS
FREQUENCY	3000 MCS
P.R.F. 2500 PULSE	6
MAXIMUM RANGE	25 N. MI.

RADAR
AIR BORNE TYPES



EMILY

EMILY, large Japanese Patrol Bomber, has a linear array in the forward part of the hull.

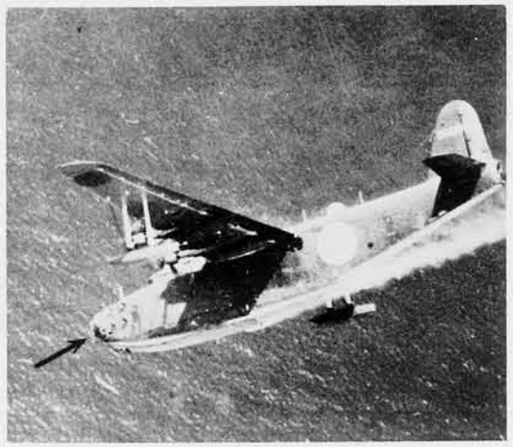
All plane types probably contain the same Radar equipment, designated as "Mark VI, Model 4", and operating at 150 mcs., with range of approximately 75 nautical miles.

Japanese Airborne Radar antennae can often be detected from aerial photographs. The Japanese probably have but one airborne model in wide use at present (MARK VI, MODEL 4), but a variety of types and locations of antennae are used. This is a search Radar.

Antennae may be a Yagi, dipole, or linear array, and may be located in the nose, leading edge of wing, or side of fuselage.

Undoubtedly, several other types will be forthcoming soon, particularly for use in night fighters.

BETTY, Japanese Medium Bomber, was the first to use Airborne Radar. The antennae consists of a nose Yagi and a small "H" shaped arrangement on the side of the fuselage.



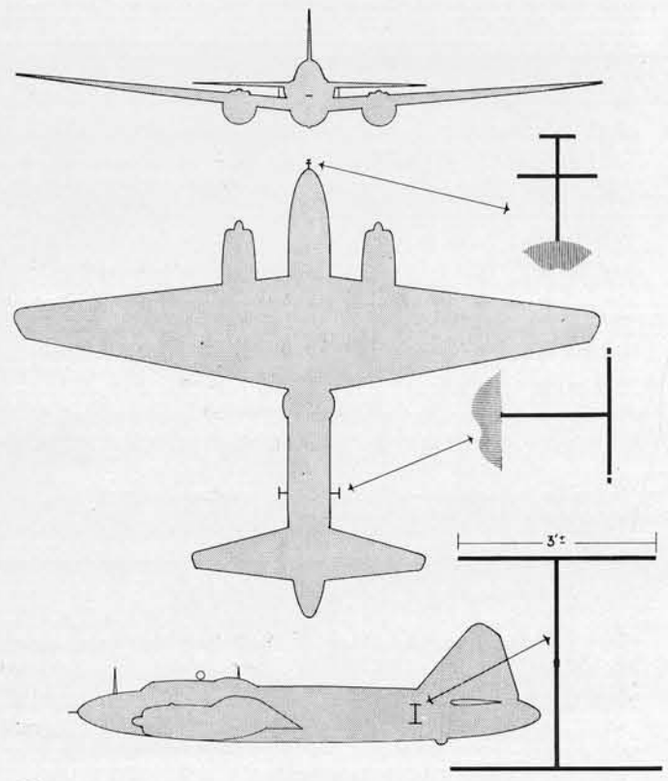
EMILY

LOCATION . . . . . EMILY
TYPE . (AIR MK. 6, MODEL 4) . "AIRBORNE"
ANTENNA . . . . . LINEAR ARRAY
FREQUENCY . . . . . 150 MCS
P.R.F. . . 1000 . . . PULSE 5
MAXIMUM RANGE . . . . . 55 N. MI.?

EMILY

BETTY

LOCATION . . . . . BETTY
TYPE . (AIR MK. 6, MODEL 4) . "AIRBORNE"
ANTENNA . . . . . NOSE YAGI & "H" ARRAY
FREQUENCY . . . . . 150 MCS
P.R.F. . . 1000 . . . PULSE 5
MAXIMUM RANGE . . . . . 55 N. MI.?



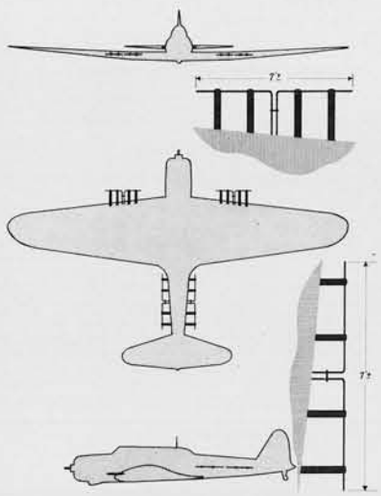
BETTY

RADAR

AIR BORNE TYPES (CONT.)

KATE, Japanese Torpedo Bomber, has been fitted with dipole antennae. There are two 5 foot dipoles on the leading edge of the wings, and two 8 foot dipoles on the sides of the fuselage. Antennae on JUDY is reported to be the same design as KATE.

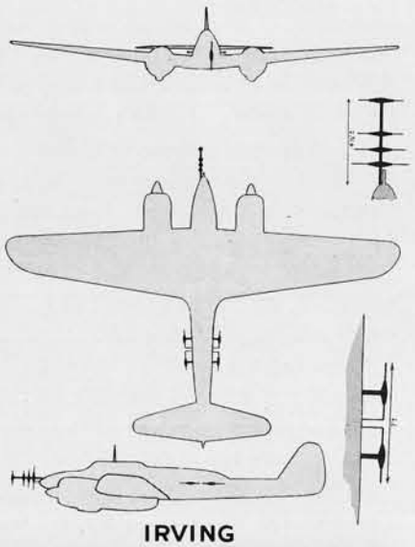
LOCATION	KATE & JUDY
TYPE . . . (AIR MK. 6, MODEL 4)	"AIRBORNE"
ANTENNA	DIPOLES
FREQUENCY	150 MCS
P.R.F. . . . 1000	PULSE 5
MAXIMUM RANGE	55 N. MI. ?



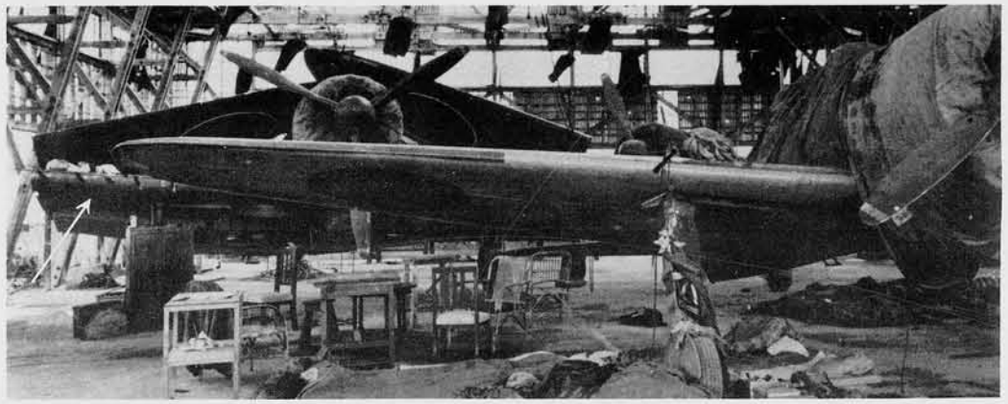
KATE

IRVING, Japanese Reconnaissance and Night Fighter plane is equipped with Yagi dipoles in the nose (similar to German designs) and a 6 foot dipole on either side of the fuselage. All dipoles are set in heavy insulators, which can be seen in fairly small photography.

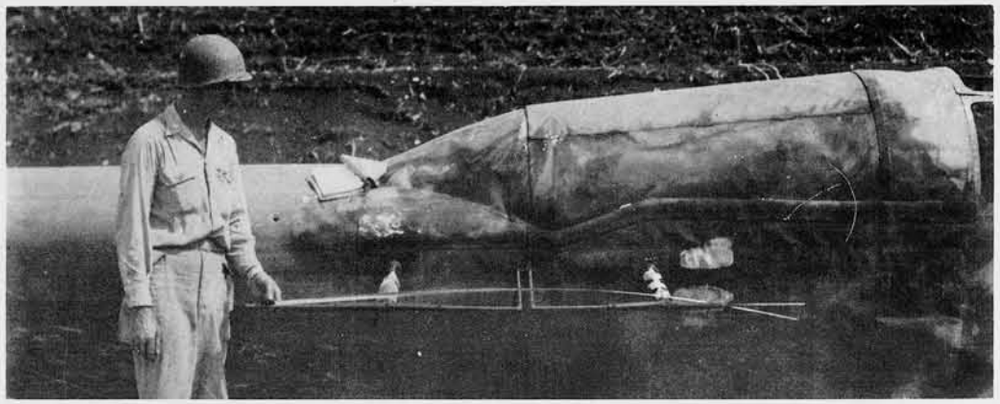
LOCATION	IRVING
TYPE . . (AIR MK. 6, MODEL 4)	"AIRBORNE"
ANTENNA	NOSE YAGI & DIPOLES
FREQUENCY	150 MCS
P.R.F. 1000	PULSE 5
MAXIMUM RANGE	55 N. MI. ?



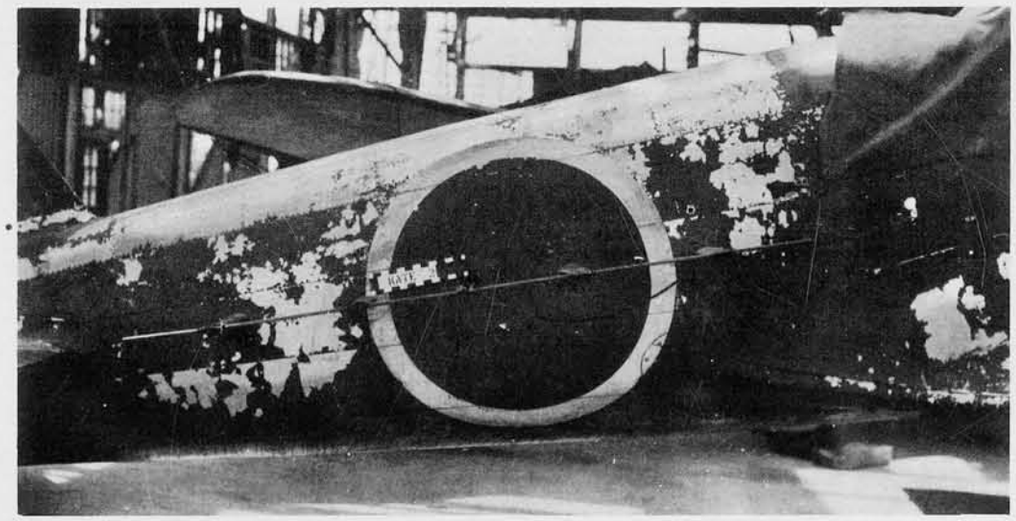
IRVING



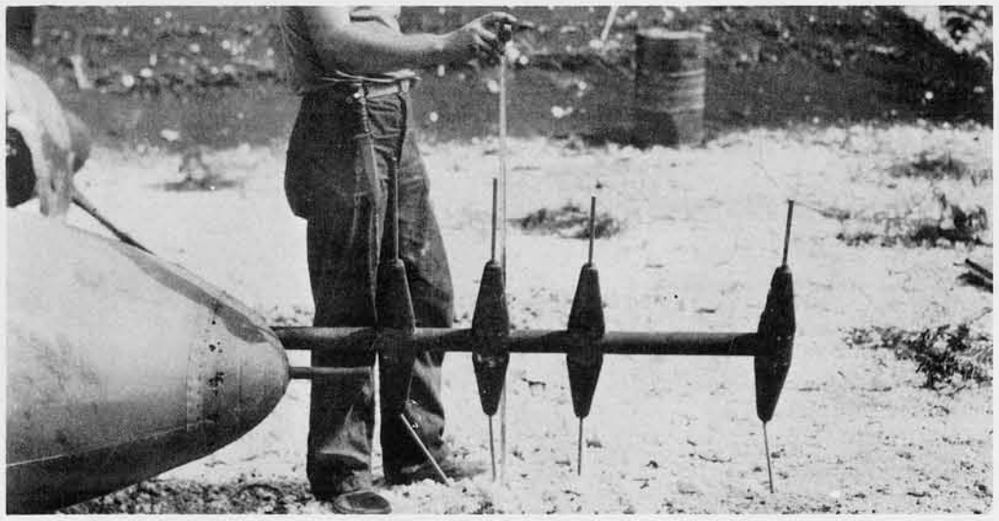
KATE



IRVING



KATE



IRVING

CONFIDENTIAL

RADAR

FIRE CONTROL (MK. IV, MOD. 3)

Japanese land-based Fire Control Radar is now coming into general use. Although information is sketchy and incomplete as to the types that may be most used, facts and pictures which are now available are shown and discussed on these pages. At this time there are apparently three basic trends in Japanese Fire and Searchlight Control Radar:

(1) Models based on British "SLC" (Yagi antennae mounted on a searchlight, which was probably captured on Singapore).

(2) Models based on the United States SCR268, probably captured on the Philippines.

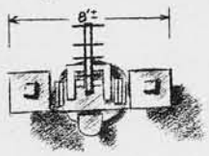
(3) Models based on British GL, Mark 2, which uses separated transmitter and receiver installations with elaborate arrays.

In addition to these general types, the possibility of the Japanese developing a copy of the German Wurzburg for land-based fire control must be kept in mind.

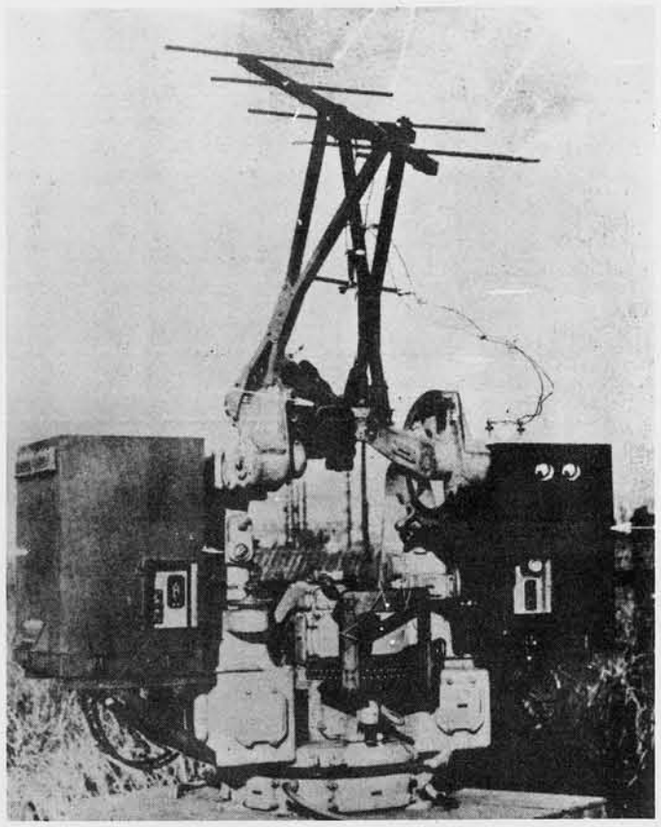
The Japanese designation of the installation shown on this page is "Mark IV, Model 3". It is a 200 mcs Radar consisting of two parts: (1) The Transmitter (mounted on a searchlight controller), which supports one row of Yagi antennae on an elevated cross arm. The whole mount, including antenna and operator's seat, rotates, and the antenna tips up and down. Radar equipment is on either side of the operator.

(2) The Receiving antenna, consisting of 4 Yagis mounted on a type 96 110 cm. searchlight. (See below, right.) It is lobe switched at 25 per second. Note that searchlight shown here is mounted on a hut.

The pictures shown here are of the first fire control equipment captured in the Pacific war, and indicate an adaptation of the British S. L. C. In these examples, it will be noted that the transmitting and receiving antennae were on separate mounts at separate locations.

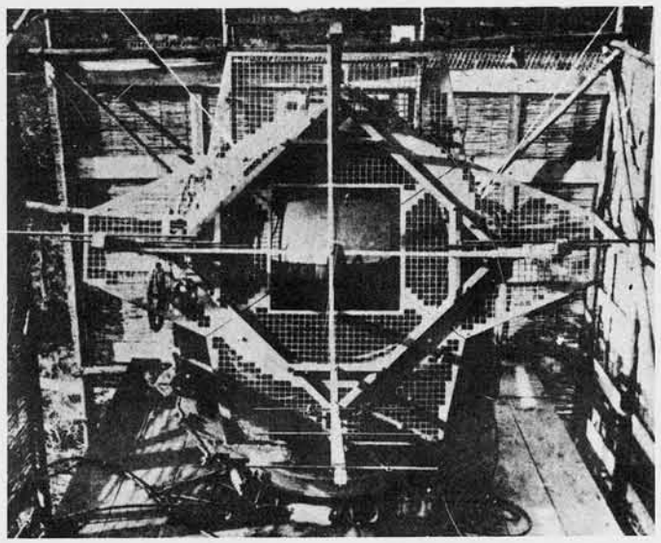


LOCATION . . . . . MARIANAS
TYPE . . . . . MARK IV, MODEL 3
ANTENNA . . . . . YAGIS
FREQUENCY . . . . . 200 MCS
P.R.F. . . 2000 . . . . PULSE . . . . . 3 - 5
ACCURACY. RANGE - 100 YDS., BEARING - 1°, ELEV - 1°

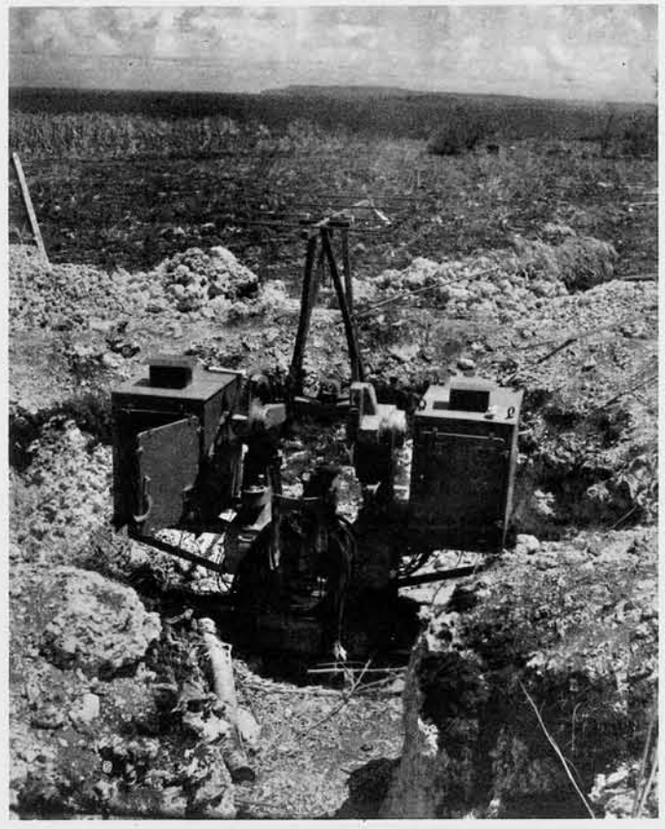


TRANSMITTING ANTENNA

The pictures shown on this page are of the first captured equipment in the Pacific war, and indicate an attempt was made to copy the British S. L. C.



RECEIVING ANTENNA



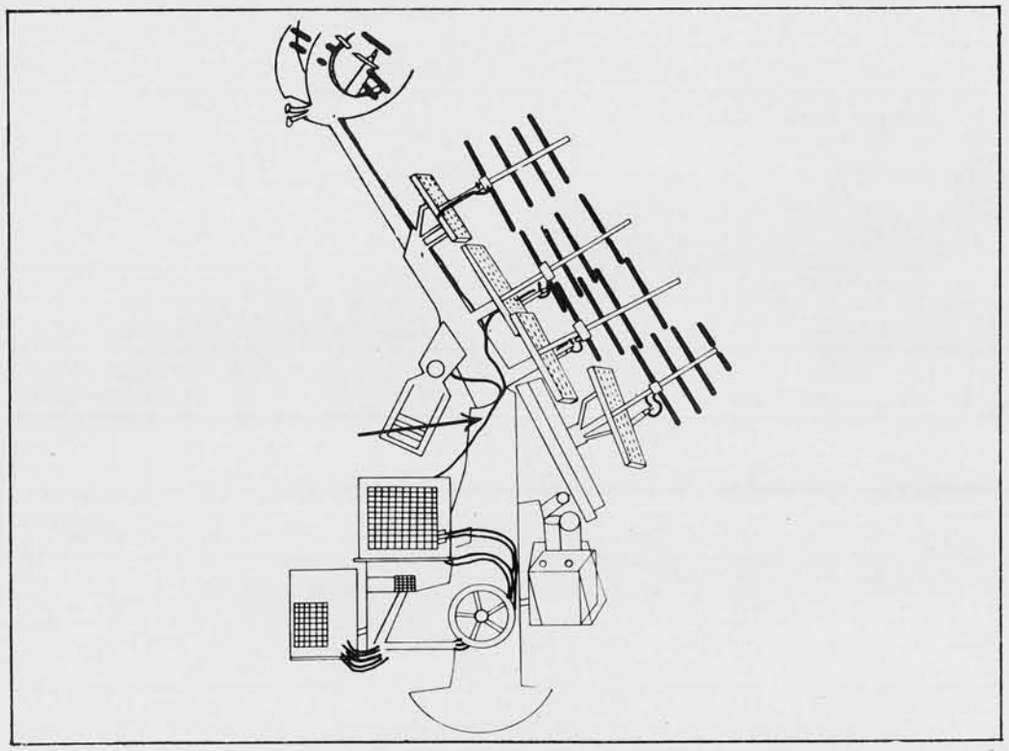
TRANSMITTING ANTENNA

In these examples, it will be noted that the transmitting and receiving antennae were on separate mounts at separate locations.

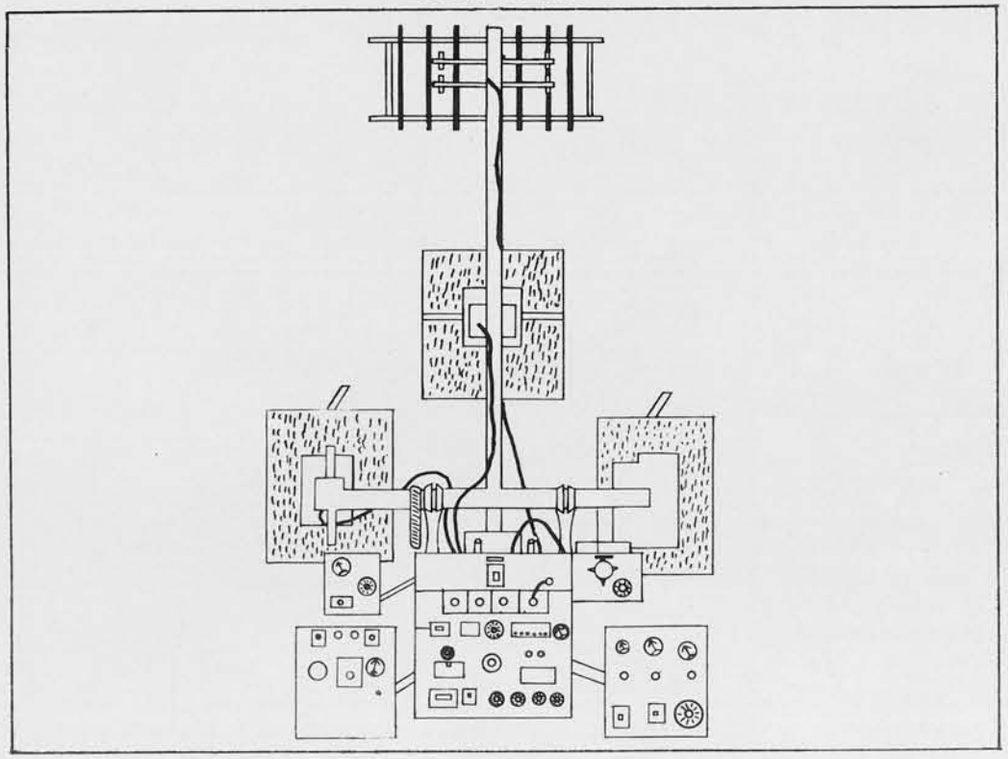
TRANSMITTER MOUNT

RADAR

(MK. TA., MOD. 1) FIRE CONTROL



SIDE VIEW



FRONT VIEW

It is thought that the Mark "TA", Model 1 A/A Fire Control Radar operates in a similar manner, basically, to the Mark IV, Model 3 which is shown on the previous page.

However, in this case, the transmitting antenna is mounted above the four receiving Yagis, on the same piece of equipment. Also, the mount is believed to be of special design and not a searchlight or searchlight controller. The frequency of this set is 200 mcs. as are most of the Japanese Fire Control Radars at this stage of development.

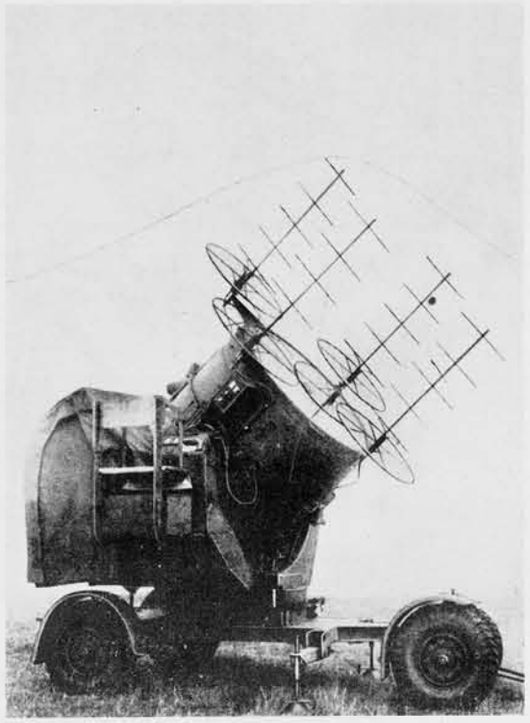
Most of the information on this page was taken from notes and sketches of a Japanese non-commissioned officer, which were made during training. The sketches leave much to be desired in clarity of drawing. Nevertheless, a rough estimate of size yields the following dimensions: front view 8 - 10 feet wide; side view 12 - 15 feet high. The whole installation rotates, and the vertical shaft appears to tip back at point A.

LOCATION	A/A OR S/L
TYPE	MARK "TA", MODEL 1
ANTENNA	YAGI S
FREQUENCY	200 MCS
P.R.F.	PULSE . . . 3

Captured documents have referred to a Mark "TA", Model 2, Fire and Searchlight Control Radar, but very little is known about this set except for the following data: Frequency - 200 Mc., PRF - 1000 Cps., Pulse - 2 microseconds, Range accuracy - 100 yards. It is listed as being designed for A/A Fire Control and Air Warning.

The antennae (5 YAGI S) are thought to be mounted on a searchlight in a manner similar to the British S.L.C., in which case both the transmitting and receiving antennae are mounted together. This is in contrast to the separated design of the Mark IV, Model 3.

A photo of the British S.L.C. (A/A, No. 2, Mark VI) is shown here for reference.



BRITISH S.L.C. (A/A, NO. 2, MK 6)

RADAR

FIRE CONTROL (MK. TA., MOD. 3)

The Mark "TA", Model 3 Fire Control Radar is believed to be radically different from Model 1 and 2 of the "TA" series.

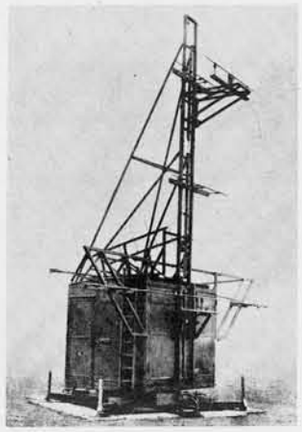
The prototype of this set is probably the British GL Mark 2 which was captured in Malaya.

Most of the present information on this Radar is taken from a captured notebook which was translated and analyzed by Gen. Hq., S.W.P.A.

This model is a Low Frequency (75 mcs.) Fire Control Radar which uses a transmitter with a five element Sterba array set close to the ground with a single dipole 20 feet above and a separated receiver which has 6 dispersed dipoles. There may be 80 to 150 feet separation between transmitting and receiving equipment.

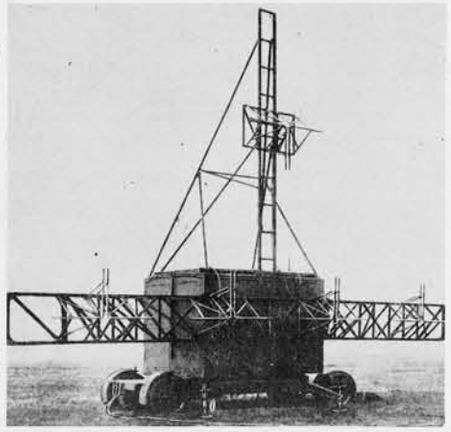
A feature of this set which should be of distinct interest to interpreters is the fact that it requires an extensive cleared area around the transmitter, and it is thought by some that a slight (swale-like) depression provides the best siting for its functions as a Fire Control Radar. At any rate, the ground must be clear of trees for a radius of 200 feet or more and should be accurately graded close to the receiver.

Sketches of the probable appearance of the Japanese Transmitter and Receiver as indicated from captured document sources, are shown here, as well as ground photos of the original British equipment from which they are believed to have been copied or adapted.

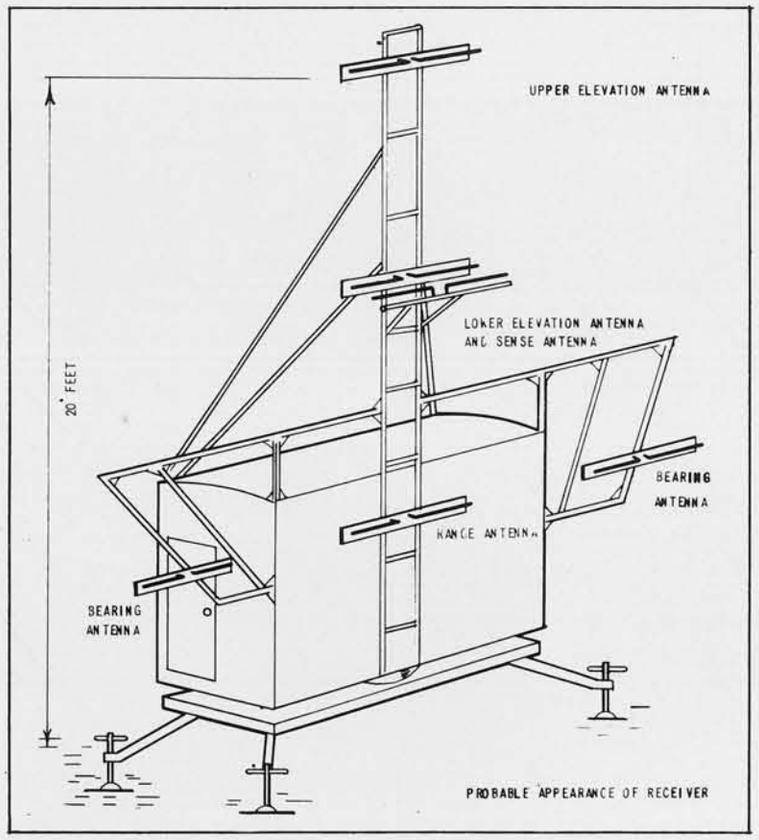


LEFT: BRITISH G.L. (A A, NO. 1, MK. 2) RECEIVER.

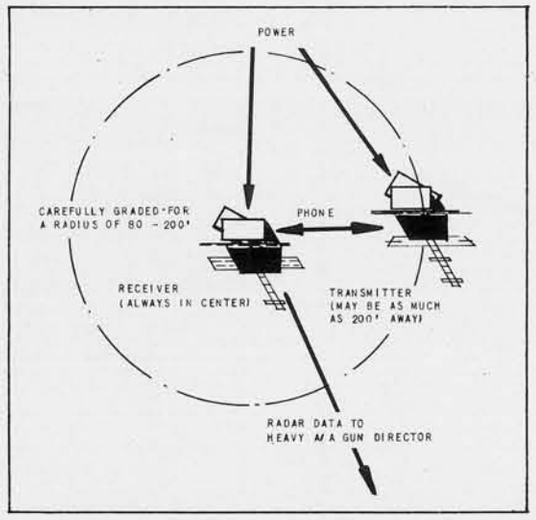
RIGHT: BRITISH G.L. (A/A, NO. 1, MK. 2) TRANSMITTER.



LOCATION	A/A OR S/L
TYPE	MARK "TA", MODEL 3
ANTENNA	STERBA ARRAY & DIPOLES
FREQUENCY	75 MCS
P.R.F.	1000-2000
PULSE	1 - 2
ACCURACY	RANGE - 25 YDS., BEARING - 0.5°, ELEVATION - 1°

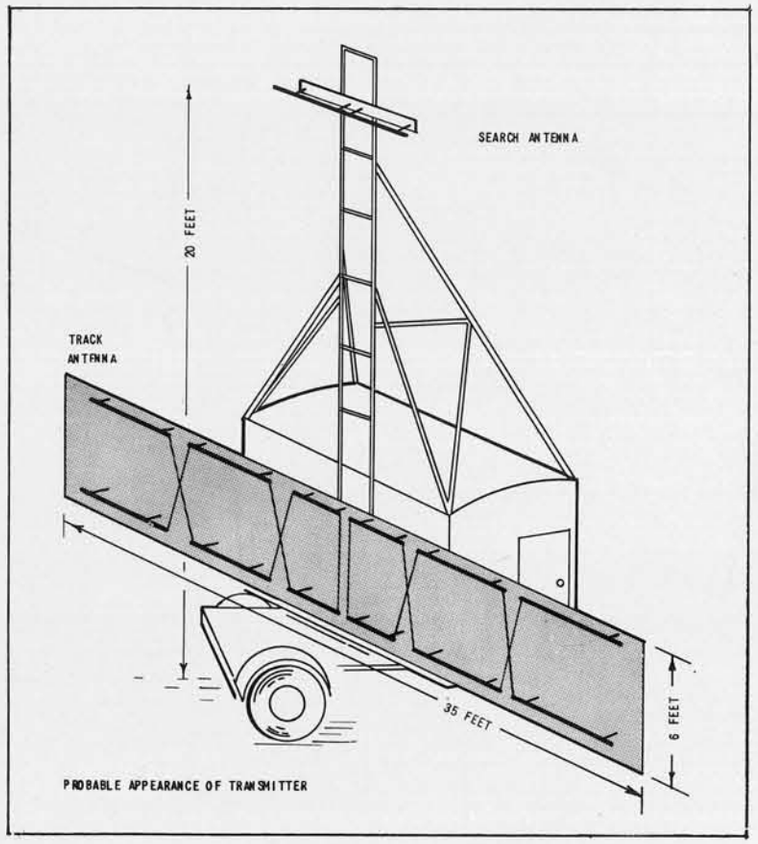


RECEIVER



HYPOTHETICAL PLAN

The above sketch represents an hypothetical arrangement of the Mark "TA", Model 3, as seen in plan view. However, the circular clearing and graded area may vary considerable in size. Ground mats may be used instead of clearing and grading.



TRANSMITTER

RADAR

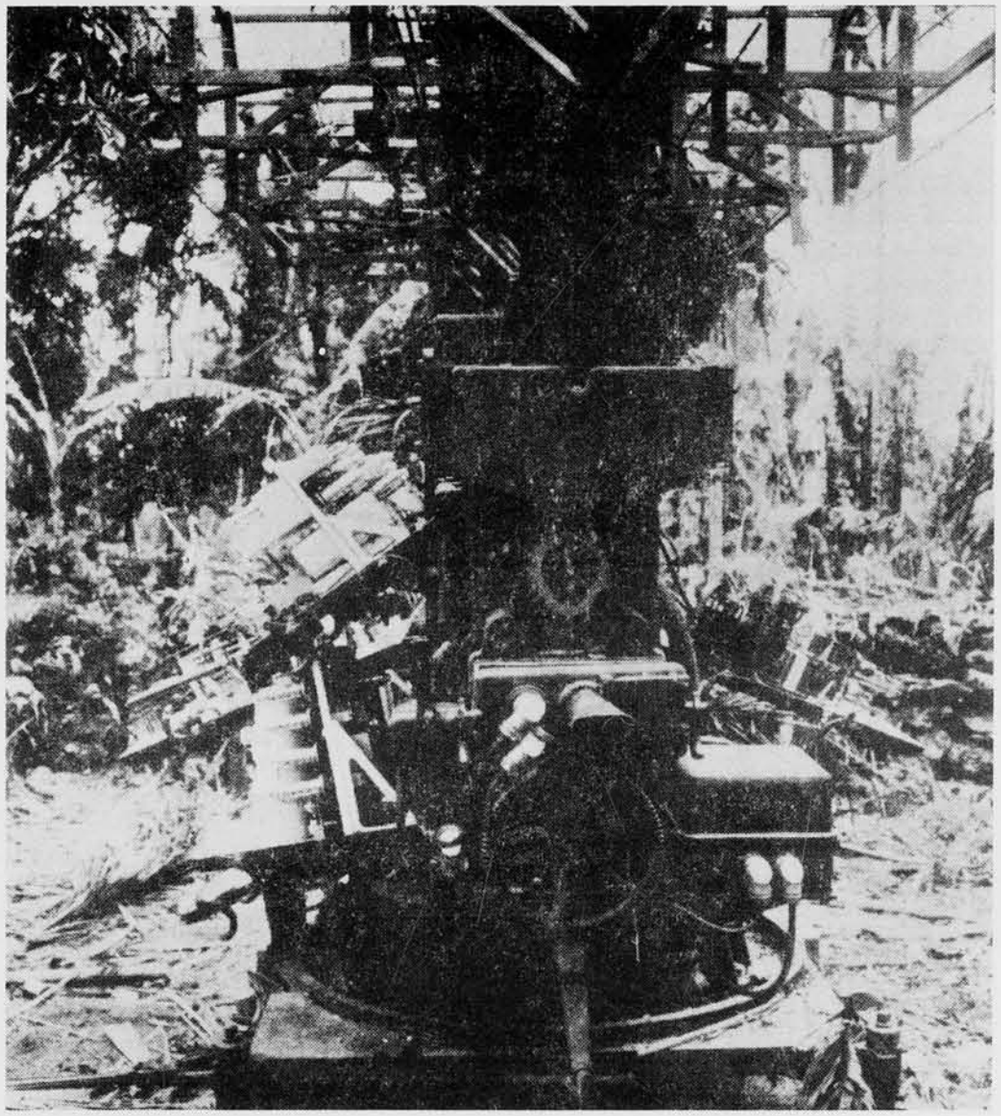
(MK. IV, MOD.I) FIRE CONTROL

The Japanese adaptation of our SCR 268 Fire Control Radar was first captured on Peleliu and is believed to be the same set referred to in captured documents as "Mark IV, Model I," and sometimes as "S-3".
The Mark IV, Model I (shown on this page) is a Fire Control Radar which operates at a frequency of 200 mcs. This set is not well adapted to mass production for wide use. Captured documents refer to a "Mark IV, Model 2" and a "Mark IV, Model 2, Modification 2" which may indicate that future use of a smaller improved model or models of this Radar, designed for mass production, can be expected.

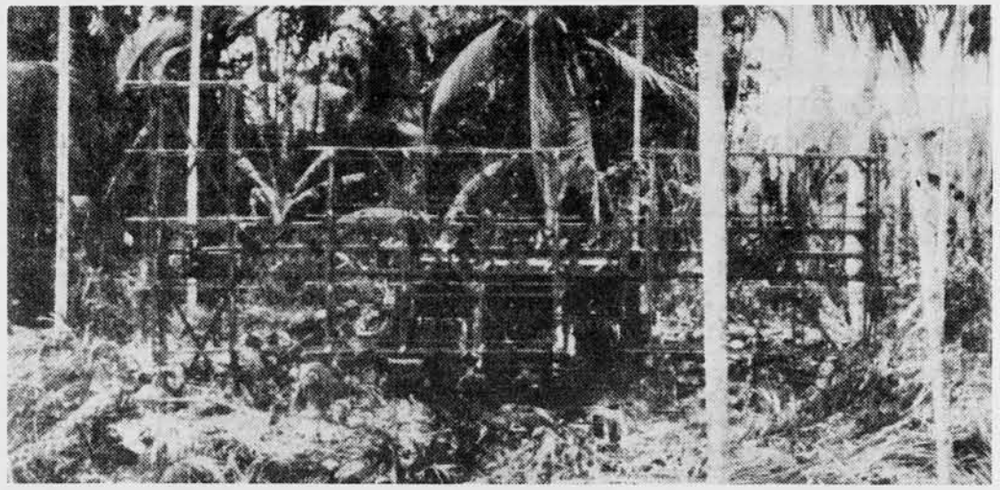
The "Mark IV, Model I" type(or types)will function better when sited in a cleared graded area.

There are three antenna bays mounted on a 25 3/4-foot long horizontal beam which in turn is mounted on top of the large frame which supports all the various units of the radar. The beam is about 9 feet above ground base. All antenna elements reflectors, radiators, and directors are lengths of 1/4 inch copper tubing mounted by means of ceramic insulators on wooden frames which are fastened to the cross beam.

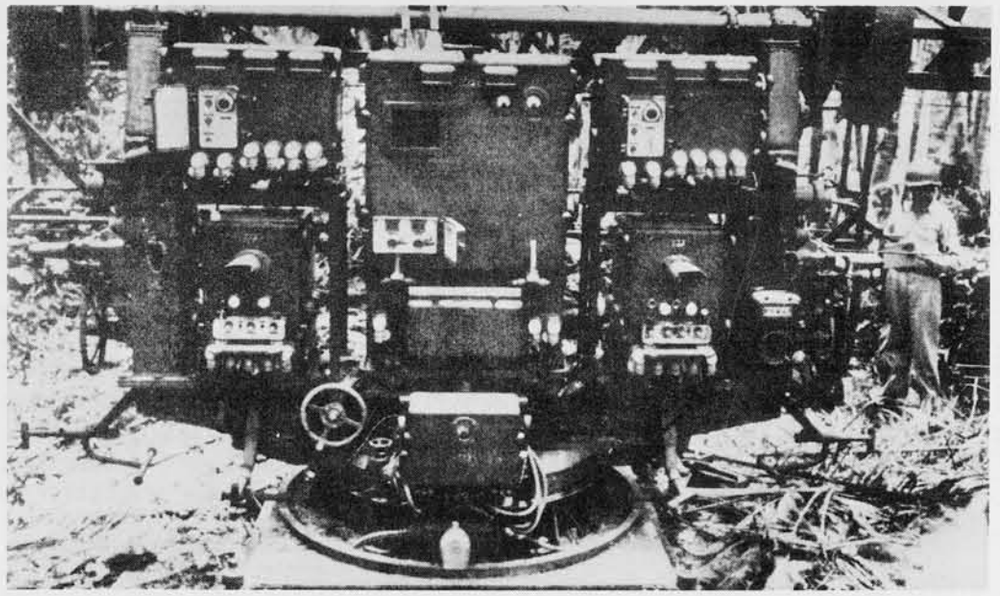
LOCATION	PELELIU
TYPE	MARK IV, MODEL I
ANTENNA	25 3/4' x 6' x 4' MATTRESS
FREQUENCY	200 MCS
P.R.F.	2000 . . . . . PULSE . . . . . 3 - 5
ACCURACY	. . . RANGE - 50 YDS. . . BEARING - 0.5° . . . ELEVATION - 0.5°



SIDE VIEW



FRONT VIEW



DETAIL OF BASE

CONFIDENTIAL

RADAR

SUPPLEMENTARY MATERIAL (FIRE CONTROL)

FIRE AND SEARCHLIGHT CONTROL RADAR

Here, under the heading, "Supplementary Material", is shown a collection of stereograms of interest to the photographic interpreter when checking on new patterns in aerial photographs which suggest Fire Control Radar.

Conservatively, all of the installations should be referred to as being "suspicious" if not "probable". However, it must be borne in mind that none have been positively identified.

To review the Fire Control Radar situation at the close of 1944, the following trends and types are believed to be in use or in production:

British "SL" Types	British "GL" Types	United States SCR 268 Types
1. Mark IV, Model 3	1. Mark "TA", Model 3	1. Mark IV, Model 1 (S-3)
2. Mark "TA", Model 1		2. Mark IV, Model 2
3. Mark "TA", Model 2		3. Mark IV, Model 2, Mod. 2

In addition to those listed above, the German Wurzburg should be watched for, as well as other Japanese types which have been reported, but on which little information is available at this time.

Fire Control Radar interpretation is also a part of gun interpretation, and an understanding of the equipment and functions of anti-aircraft fire control centers and guns is helpful to identification. (See P.I.C. Publication #3: "Japanese Anti-aircraft and Coastal Defense Guns")

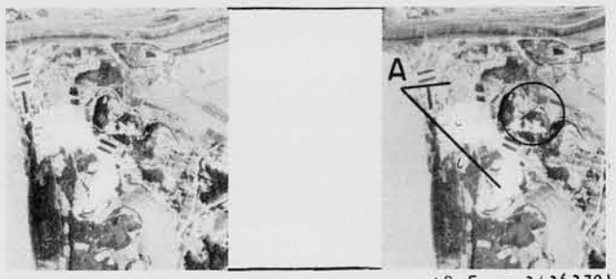
Certain specific forms and patterns have been observed repeatedly in pictures taken over Japanese-controlled territory, which have created suspicions as to the presence of Fire Control Radar. In each case the forms in question are found close to heavy A/A and are sited fairly well for the functions of Fire Control Radar. It is believed, further, that such forms and patterns do not represent other known functions of A/A fire control such as directors, visual range finders, sound locators, searchlights, etc.

In general, these forms and patterns may be classified as follows:

1. A circular cleared area, often with a saucer-shaped depression, with a diameter of from 150' to 200'.
2. A 22' diameter cylindrical form, about 10' high (possibly with a conical roof) out of the center of which extends a vertical shaft supporting a cross-arm (antennae ?). The whole is frequently enclosed in a low revetment of 50' diameter.
3. A small circular revetment, enclosing "something", from which a buried cable is observed running to the fire control center (to the director ?) and thence to the heavy A/A guns.

It must be borne in mind that A/A Fire Control Radar need not be sited on the highest point of land, but often will be found in low flat areas, wide valleys, and frequently on the same level or lower than the heavy A/A guns.

When searchlight revetments are found accompanied by another circular revetment, and not in the immediate vicinity of heavy A/A batteries, the extra revetment is likely to contain either Searchlight Control Radar or a Sound Locator.



UNIDENTIFIED (R.F. - 1/16170)

UNIDENTIFIED (R.F. - 1/16170)

UNIDENTIFIED (R.F. - 1/16170)

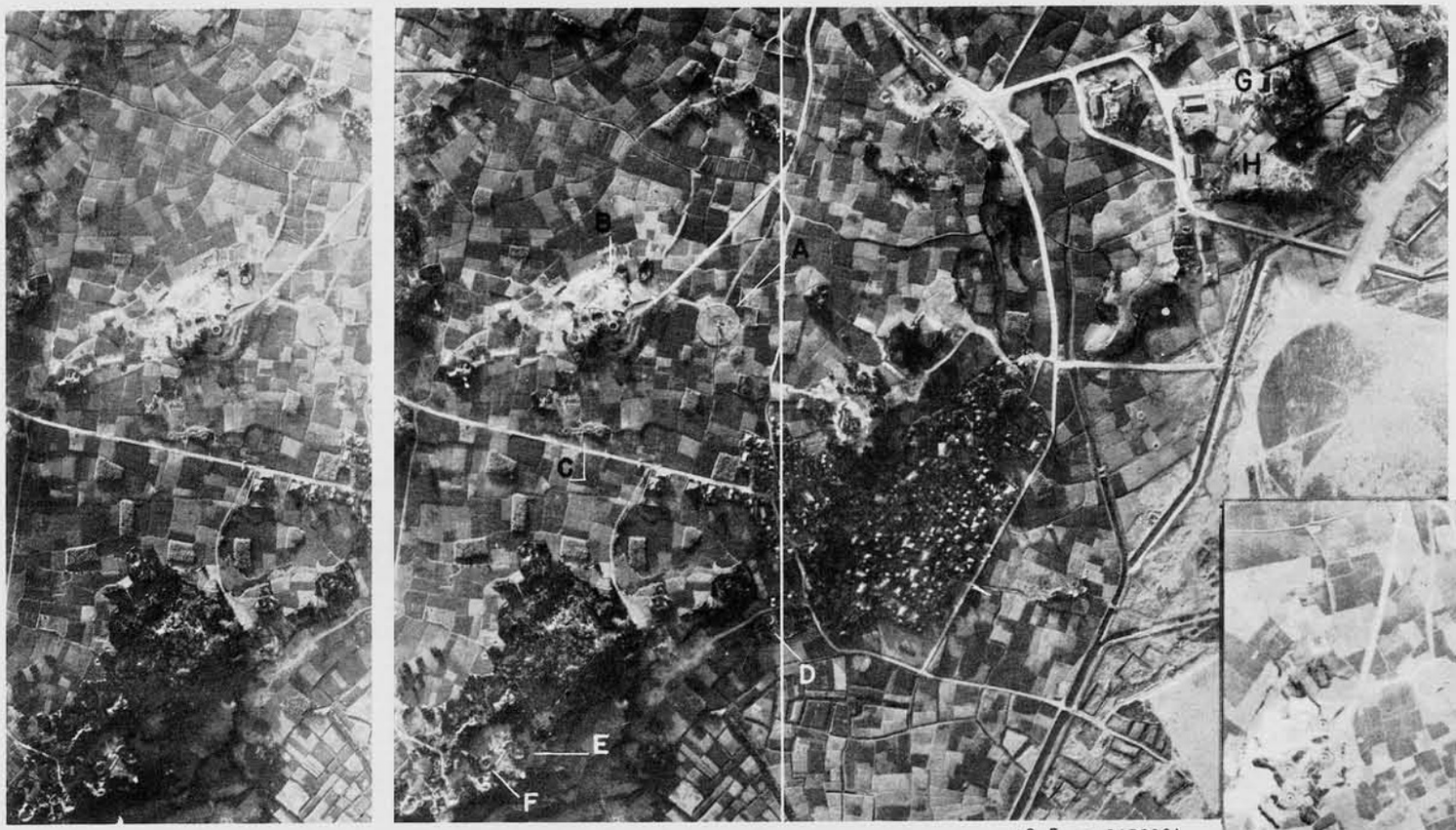
ABOVE:
The cylindrical form is similar in shape and dimensions to the standard concrete water cistern, i.e., 20-22 feet in diameter and approximately 10 to 12 feet in height. The revetment is about 50 feet inside diameter. A definite shadow, presumably from a horizontal cross arm erected on top of this structure, looks very much like antennae and causes speculation on the possibilities of the installation enclosing Fire Control Radar. Each of these installations is in association with two 6-gun heavy A/A batteries marked "A".

RIGHT: One of the numerous types of circular clearings seen recently. This particular one on Honshu contains Mark "TA", Model 3 Fire Control Radar.

PROBABLE MK. "TA", MOD.3 (R.F. - 1/17000)

RADAR

SUPPLEMENTARY MATERIAL (FIRE CONTROL)



PROBABLE MK. IV, MOD.1 (R.F. - 1/7500)

"A" - Probably Fire Control Radar. "B" - 4-Gun 120 mm. AA Battery (Also construction activity). "C" - 25 mm. AA Guns. "D" - Device For Processing Sugar Cane or Rice. "E" - Searchlight (150 cm.?). "F" - Sound Locator. "G" - Probable Searchlight (110 cm.?). "H" - Unidentified Construction, possibly S/L Control Radar.

The installation at "A" although not conclusively identified, is believed to be the "Mark IV, Model 1, S-3" Fire Control Radar, an adaption of United States type SCR 268. It is mounted in the center of a 150' diameter circle having a concave cross section resembling a saucer shape.

Note the presence of a drainage ditch leading out from the center of the circle. An underground entrance and a low guyed stick mast are also present. Radar is 550 feet from the nearest heavy AA gun emplacement ("B").

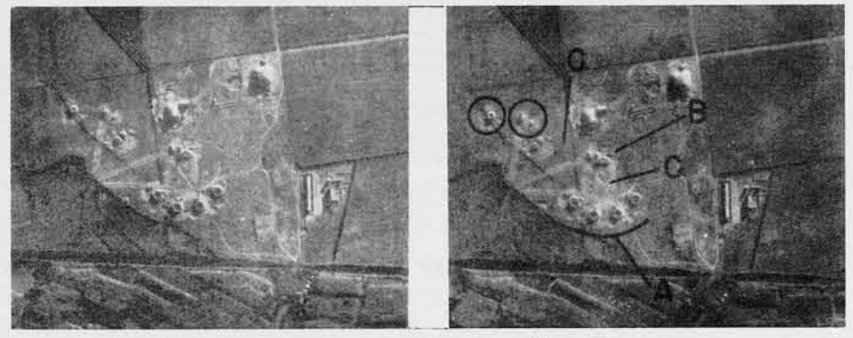
(R.F. - 1/5500)

PROBABLE MK. IV, MOD.1

UNIDENTIFIED

"A" - HEAVY A/A GUNS (127 MM?) "B" - FIRE CONTROL CENTER

Encircled forms are saucer-shaped and are 150 feet in diameter. The sides of the saucer are built up above grade. The lowest part of the saucer is probably on grade or slightly below. A shadow from a vertical shaft is seen in the left emplacement.



SUSPECTED MARK IV, MODEL 3

"A" - HEAVY A/A BATTERY "B" - FIRE CONTROL CENTER "C" - BURIED CABLE

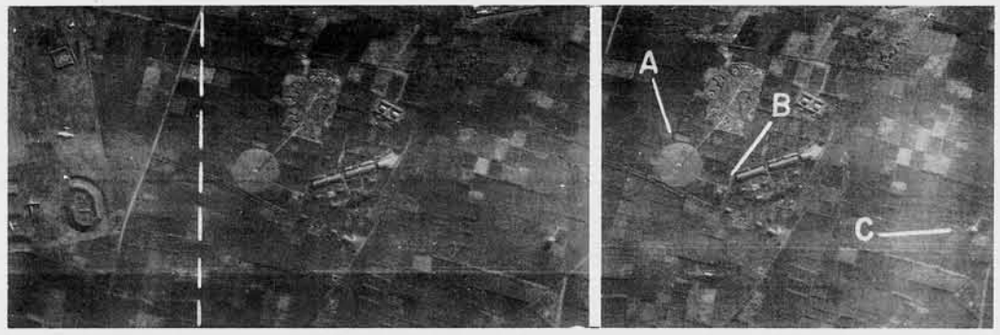
The encircled emplacements above are believed to contain Fire Control Radar equipment, possibly Mk. IV, Mod. 3. (If only one emplacement is in use, Mk. "TA", Mod. 1 or 2 would be likely.) Note underground cable leading to Fire Control Center, a distance of 550', and thence to each heavy A/A gun position.

RADAR

SUPPLEMENTARY MATERIAL (FIRE CONTROL)

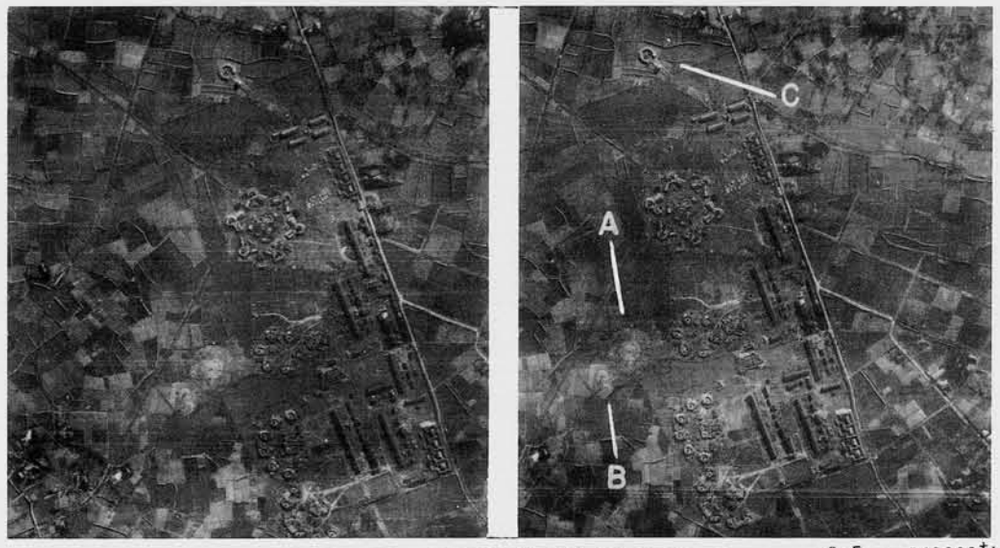
The Mark "TA", Model 3 Fire Control Radar, which is an adaptation of the British GL, Mark 2, has been the most frequently identified model up to the present, particularly on Honshu. This is partially due to the ease of recognition of this particular type. Three examples which are believed to contain Mark "TA", Model 3 are included on this page.

Two Searchlight Stations with accompanying Sound Locator revetments are included here for comparative purposes.



PROBABLE MARK "TA", MODEL 3 (R.F. - 1 9000±)

"A" - RECEIVER; "B" - TRANSMITTER; "C" - SUSPECTED D.F.



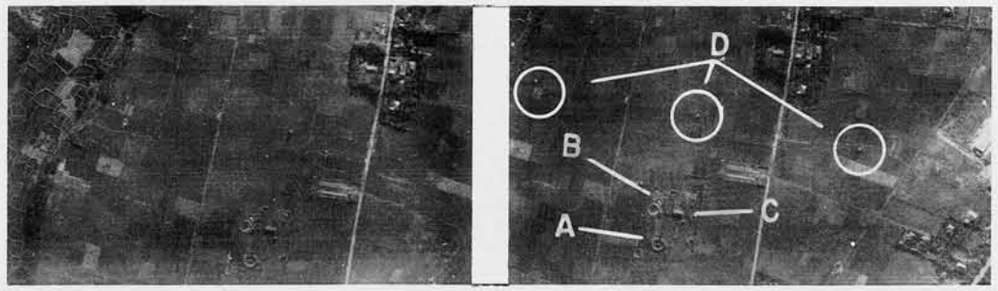
PROBABLE MARK "TA", MODEL 3 (R.F. - 1/9000±)

"A" - RECEIVER; "B" - TRANSMITTER- "C" - SEARCHLIGHT

The two stereograms shown above are good examples of Mark "TA", Model 3. Fire Control Radar set up with heavy A/A gun batteries.

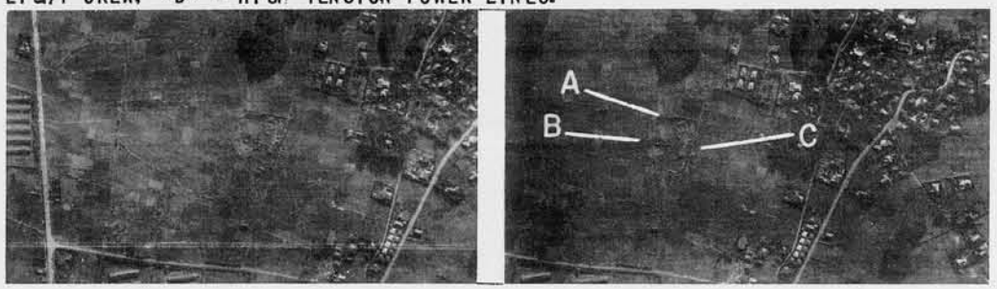
The circular clearings around the transmitter are about 200' in diameter and are carefully graded. (The inner circular clearing in lower stereogram is 100' in diameter.) Cable lines run between the transmitter and the Receiver and from the Receiver to the Director (in the Fire Control Center). Receiver is usually 500' - 600' from the Fire Control Center.

All guns shown are 75 millimeter except the hexagonal battery in lower stereogram which is probably composed of 120 millimeter guns.



SEARCHLIGHT (R.F. - 1/9000±)

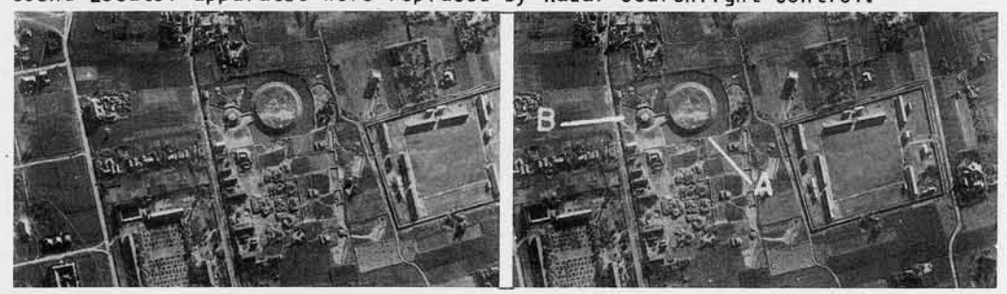
"A" - SEARCHLIGHT; "B" - SOUND LOCATOR; "C" - BARRACKS BUILDING FOR SEARCHLIGHT CREW; "D" - HIGH TENSION POWER LINES.



SEARCHLIGHT (R.F. - 1/9000±)

"A" - SEARCHLIGHT; "B" - SOUND LOCATOR; "C" - BARRACKS BUILDING FOR SEARCHLIGHT CREW.

The two stereograms shown above are of Searchlight Stations with Sound Locator control. These are included for comparison with Radar Fire Control emplacements. Although these are fairly typical examples of Sound Locator revetments, it would be difficult to ascertain, at this scale, if the Sound Locator apparatus were replaced by Radar Searchlight Control.



SUSPECTED MARK "TA", MODEL 3 (R.F. - 1/9000)

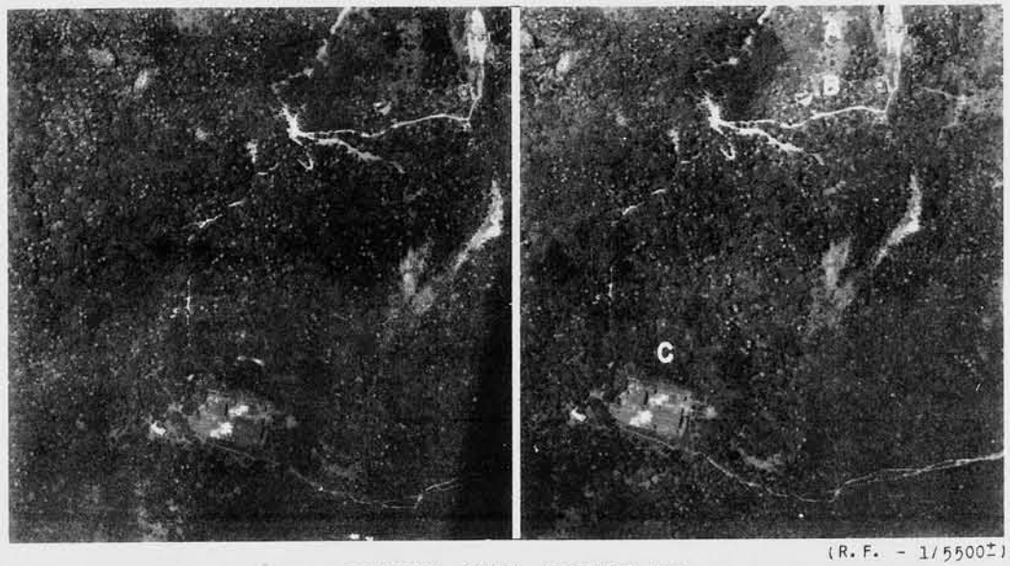
"A" - RECEIVER; "B" - TRANSMITTER.

In this stereo, the form that resembles a buried fuel tank is apparently surmounted by a Mark "TA", Model 3 Receiver. The A/A battery appears to be composed of 75 mm. guns. This is a smaller group of guns than is usually found with Radar Fire Control of this type.

Several other examples of Mark "TA", Model 3 have been found recently (in addition to those shown in this book). At the present time, it has been identified more frequently than any other type - but this may be partially due to the fact that it offers the most obvious identifying characteristics.

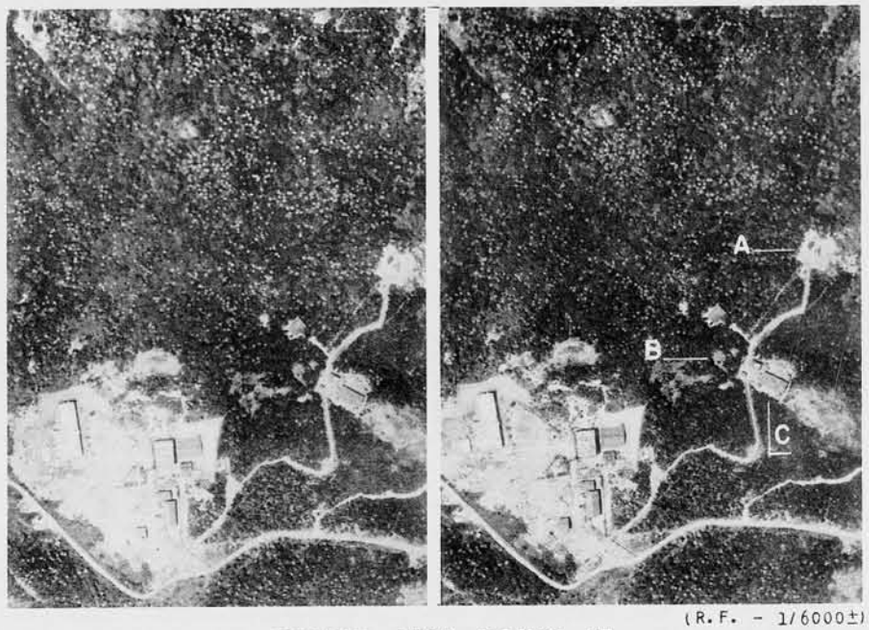
RADAR

SUPPLEMENTARY MATERIAL (SEARCH)



(R.F. - 1/5500±)

CHICHI JIMA, BONIN IS.



(R.F. - 1/6000±)

CHICHI JIMA, BONIN IS.

Two radar sites on Chichi Jima show a standardization of associated structures which may prove helpful for interpretation at scales too small to clearly identify the Radar itself.

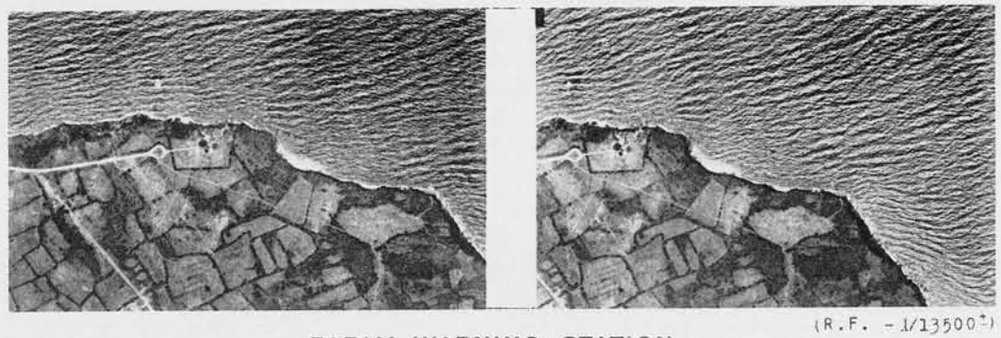
"A" - MARK I, MODEL I RADAR.
"B" - OBSERVATION PLATFORM ON TOP OF BUILDING.
"C" - PROBABLE BARRACKS BUILDING.

Radio Station at "D" is 700 feet from Radar, and is not related.

(R.F. - 1/13000)

DARIEN, MANCHURIA

Unidentified installation at Darien, Manchuria, which is thought to be a long range Early Warning Coastal Radar similar to the German "Large Hoarding". The screen is 90 feet long by 30-35 feet high, set atop a hill in such a manner as to command the harbor and its approaches.
Signals have been reported from this general area which tend to support this interpretation. Larger scale pictures are necessary for final identification.

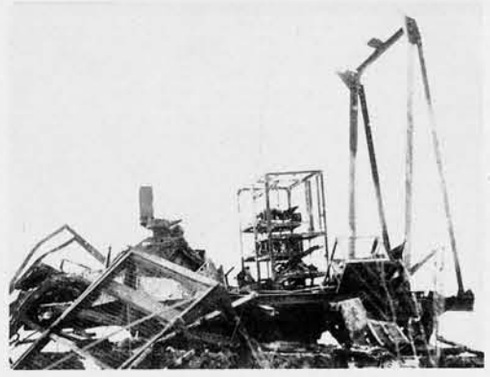


(R.F. - 1/13500±)

EARLY WARNING STATION

A Japanese Coastal Early Warning Station, above, in the Philipines, is sited in a similar manner to many German examples. Station includes, two Radars - an "Attu" type and a "Chi" type.

GUADALCANAL TYPE - SAIPAN



ATTU TYPE - TINIAN

Views of badly damaged Radars captured on Tinian and Saipan illustrate the fact that both the Guadalcanal Type and the Attu Type Radars are still in use in the same general area.
Both of these radars were clearly visible in pre-invasion vertical coverage.

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL

[redacted]

SUPPLEMENTARY MATERIAL

RADAR (GERMAN)

SUMMARY

Examples of German Radar are included here to cover the possibility that the Japanese may have access to German equipment and technicians.

The Germans employ several types of land based installations covering the functions of Air Search, Fire Control, and Coast Watching.

These types are quite well standardized and are much more efficient apparatus than those the Japanese are known to have.

There is now some photographic evidence of German Radar equipment in use by the Japanese. Also, it is known that many other types of German electronics equipment are being used.

The following table represents the latest list of German Radar types with salient information concerning each.

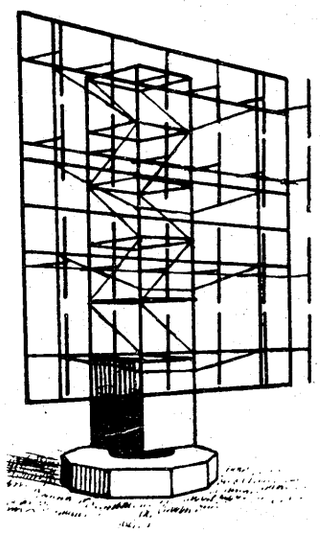
GERMAN LAND BASED RADAR TYPES

NAME	SIZE OF SCREEN*	TOP OF SCREEN ABOVE GROUND	FREQUENCY	RANGE IN NAUTICAL MILES	USE	PAGE NO.
LIMBER FREYA	20'x16' IFF-16¼'x3½'	26 3/4' - 30' WITH IFF	116-146 MCS.	75	A.S.	1.31
POLE FREYA	20'x16' IFF-16¼x3½ OR 20'x8'	32', 35' OR 40' WITH IFF	116-146 MCS.	100	A.S.	1.31
GIRDER CHIMNEY	19½'x97½'	115'	120-130 MCS.	110	A.S.	1.33
CYLINDRICAL CHIMNEY	60'x97½' IFF .22' HIGH	110½'	120-130 MCS.	160	A.S.	1.33
GEMA COASTWATCHER	20'x8'	25'	370-390 MCS.	DEPENDS ON ELEVATION (ASL) OF SITE	C.W.	1.34
LARGE COASTWATCHER	35'x 34'	40'	70-90 MCS.	60-75	C.W.	1.35
SMALL HOARDING	63 3/4 x 44 3/4	50'			C.W.	1.36
LARGE HOARDING	98'x36½'	50'	120-130 MCS.	100-115	C.W.	1.36
SMALL WURZBURG	10' DIAMETER	12½' IN VERTICAL POSITION	550-580 MCS.	25	F.C.	1.37
GIANT WURZBURG	24' DIAMETER	27' IN VERTICAL POSITION	470-580 MCS.	40	G.C.I., A.S. & C.W.	1.38

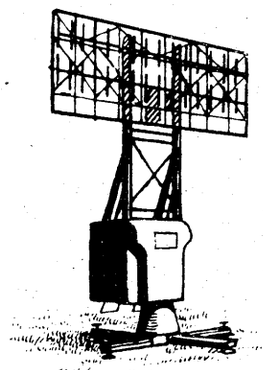
* - WIDTH (HORIZONTAL DIMENSION) GIVEN FIRST
A.S. - AIR SEARCH
F.C. - A/A FIRE CONTROL
C.W. - COAST WATCHING
G.C.I. - GROUND CONTROL INTERCEPT

[redacted]

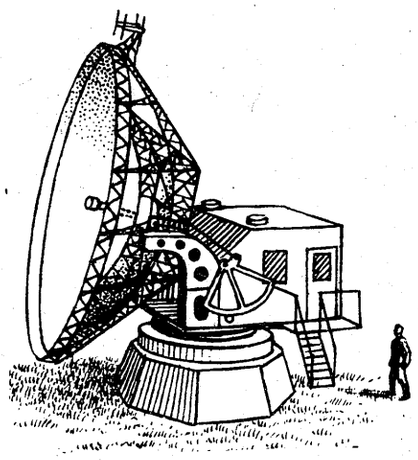
RADAR
SUMMARY (CONT.)



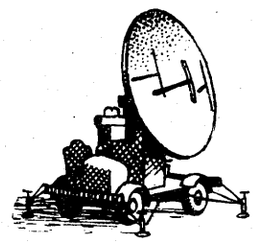
LARGE COASTWATCHER



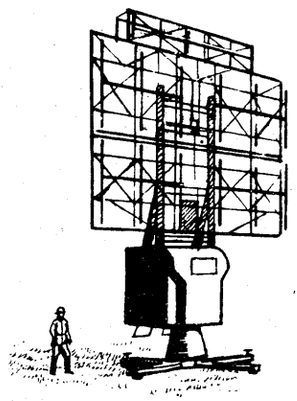
GEMA
COASTWATCHER



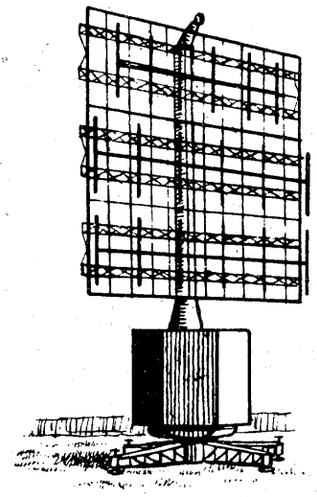
GIANT WURZBURG



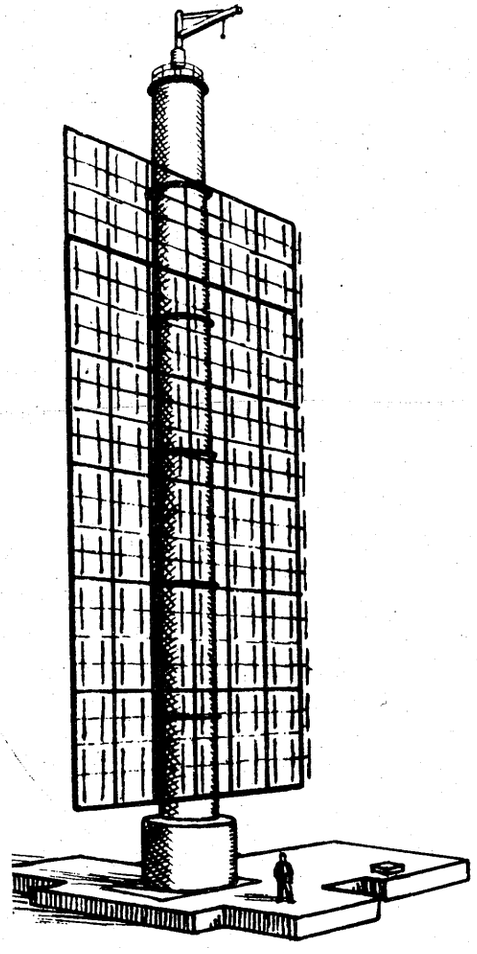
SMALL WURZBURG



LIMBER FREYA



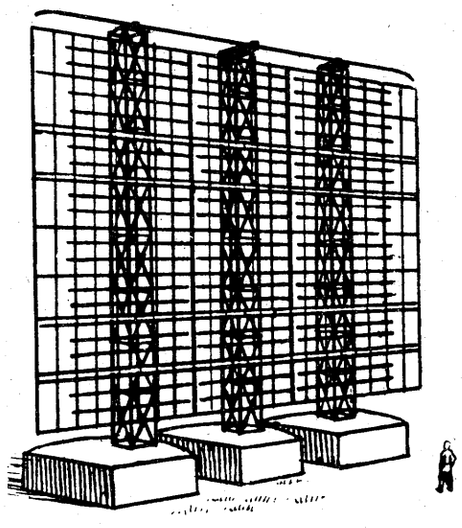
POLE FREYA



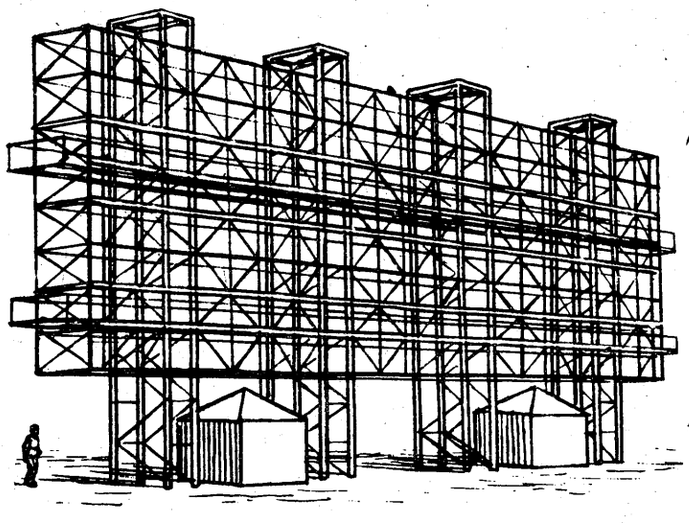
CYLINDRICAL CHIMNEY

Drawings of all of the basic German Radar types are included on this page. Best known popular names are used for the designation of each type. It will be noted that these designs are quite well standardized for each particular use, and identification is easier because of this fact.

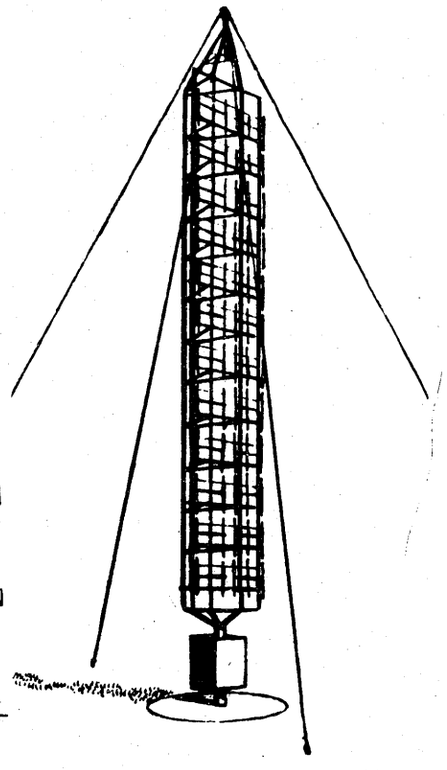
In most cases, this German equipment is superior to that now in use by the Japanese. A constant watch for German type designs of Radar in Japanese held territory is therefore in order.



SMALL HOARDING



LARGE HOARDING



GIRDER CHIMNEY

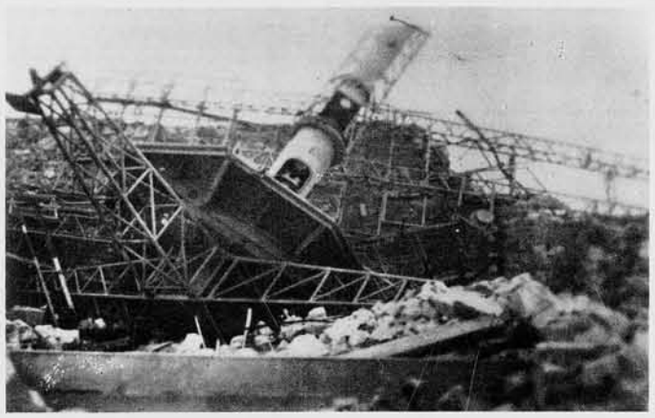
RADAR (GERMAN)

FREYA

The Limber Freya is one of the earliest types of German equipment, developed for air search or early warning. The Pole Freya is a later mechanical development, but the electrical performance is much the same. Both types may or may not support the I.F.F. array. The operating cabin is 7' square.

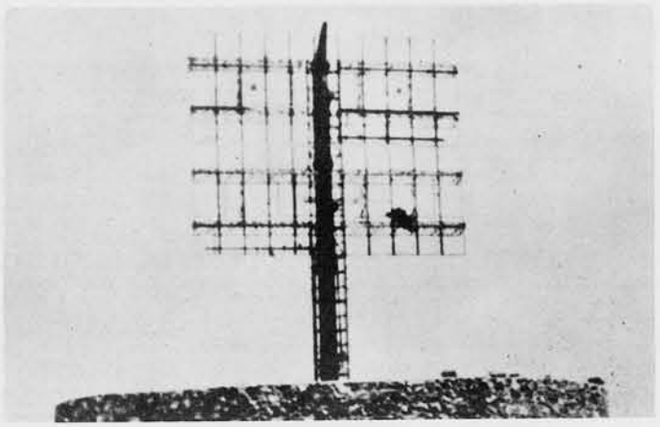
The high blast wall is a characteristic of Freya installations. This Pole Freya is minus the I.F.F. The Pole type is assembled from a number of small parts, thus making it more suitable for air transport.

Practical range of Limber Freya is 75 Naut. miles.
Practical range of Pole Freya is 100 Naut. miles.
Frequency is 116 - 146 Mcs.

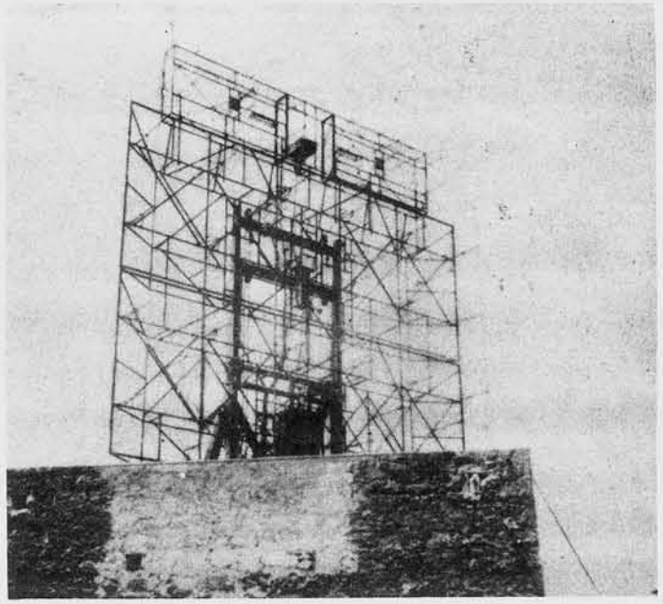


POLE FREYA

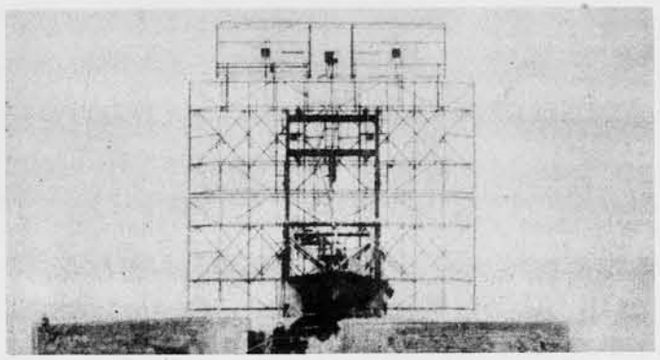
Two views of badly damaged Pole Freya, showing details of the Pole support for aerial and the four arm girder-like base supporting the turn table. The operating cabin is octagonal in plane view (approx. 10' across). Note giant Wurzburg in the background.



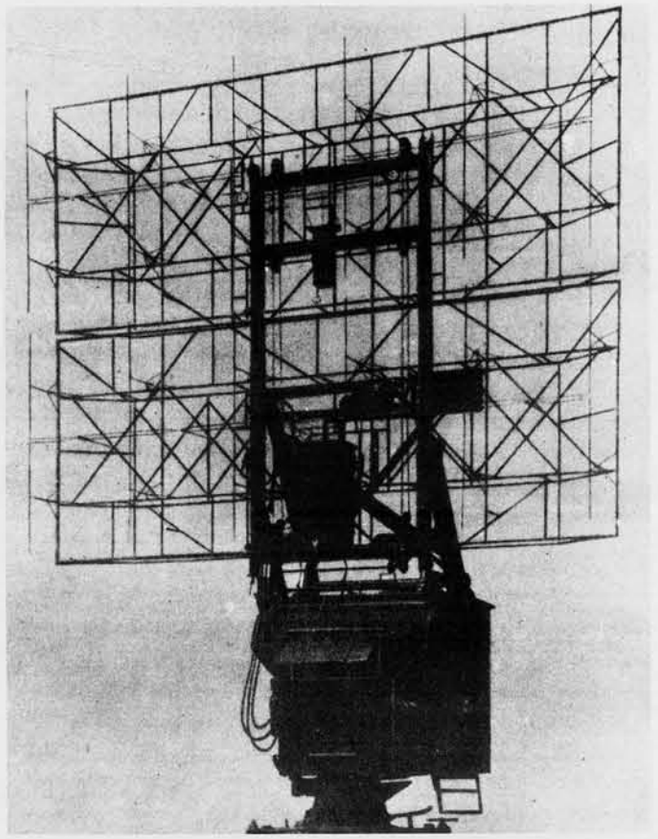
POLE FREYA



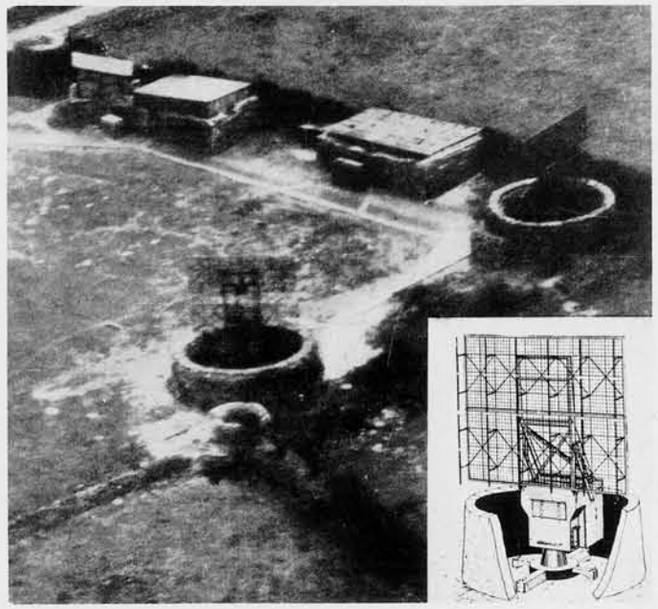
LIMBER FREYA WITH I.F.F.



LIMBER FREYA WITH I.F.F.



LIMBER FREYA

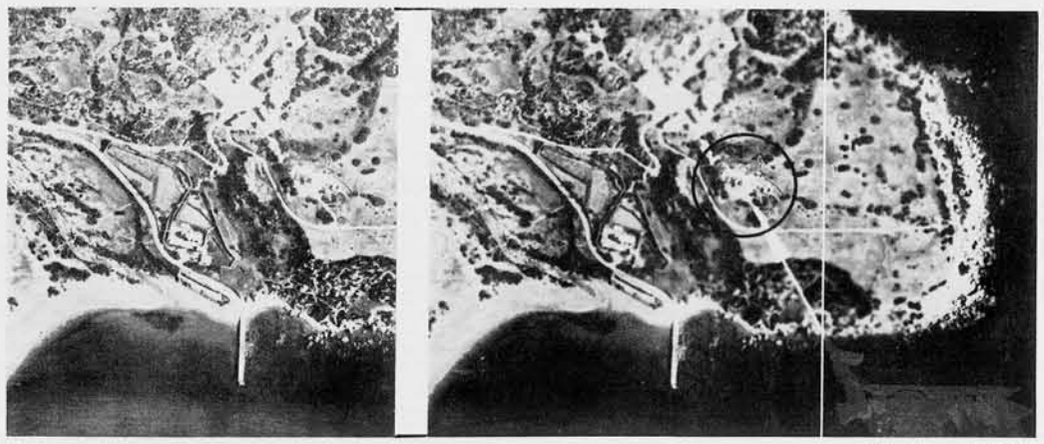


LIMBER FREYAS

CONFIDENTIAL

RADAR (GERMAN)

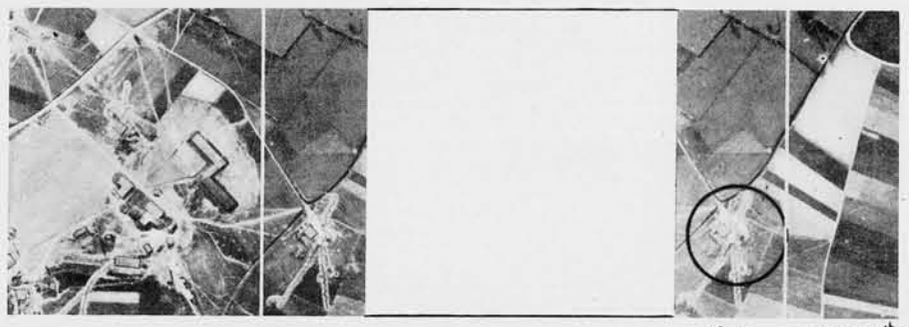
FREYA (CONT.)



(R.F. - 1/8000

FREYA

The Freya is the most used of German Search Radar and is employed in a variety of ways, among which are early warning, ground control of A/C, and coastwatching, etc.

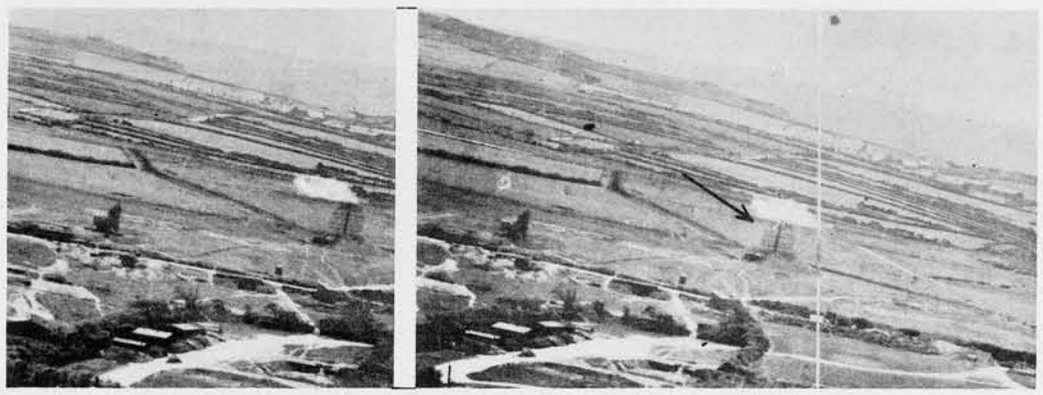


(R.F. - 1/10000)

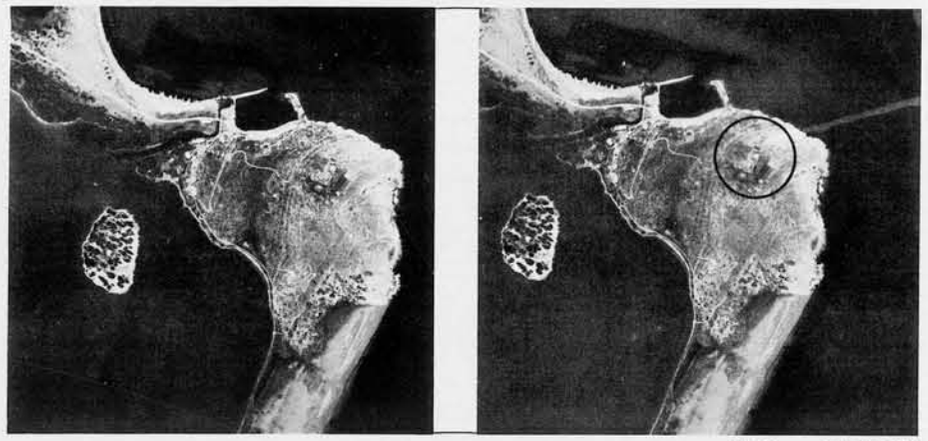
FREYA

Above are seen two Freyas (one in stereo), which appear to be in conjunction with S/L Stations.

The oblique stereogram shown below contains one Pole Freya with 16' wide I.F.F. and one giant Wurzburg.

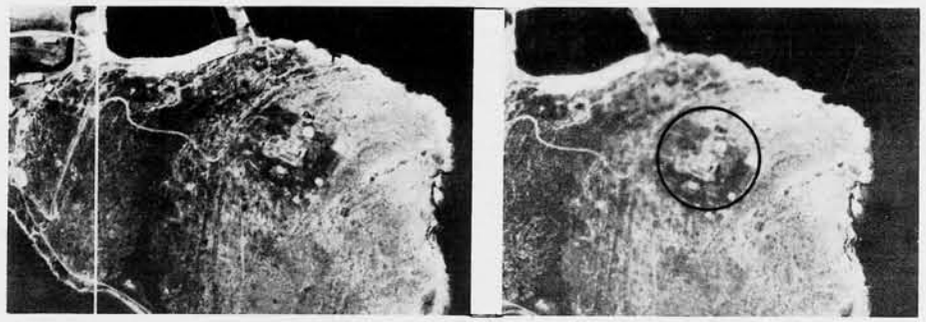


POLE FREYA WITH GIANT WURZBURG



(R.F. - 1/15200)

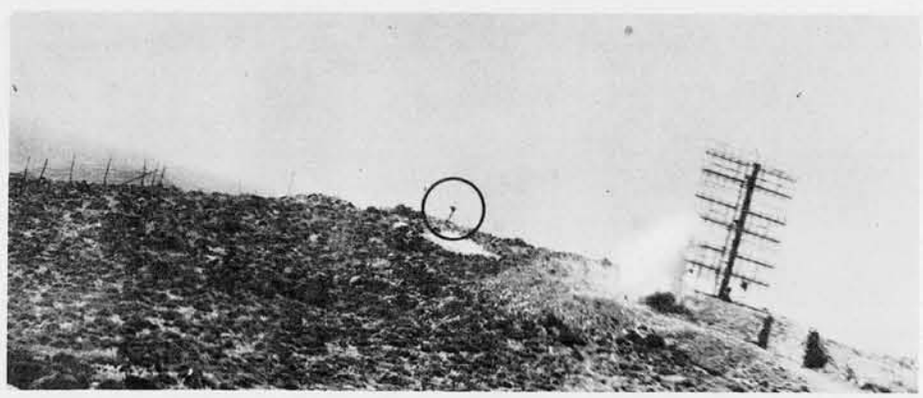
FREYA



(R.F. - 1/7500)

FREYA

BELOW: This installation in Greece shows a Pole Freya with the 20' wide I.F.F. under attack by a plane. The encircled object appears to be a portable voice carrying light beam signal device which, although of German design, is also in use by Japanese. Its range is approximately 8 miles and it cannot be jammed or intercepted successfully.

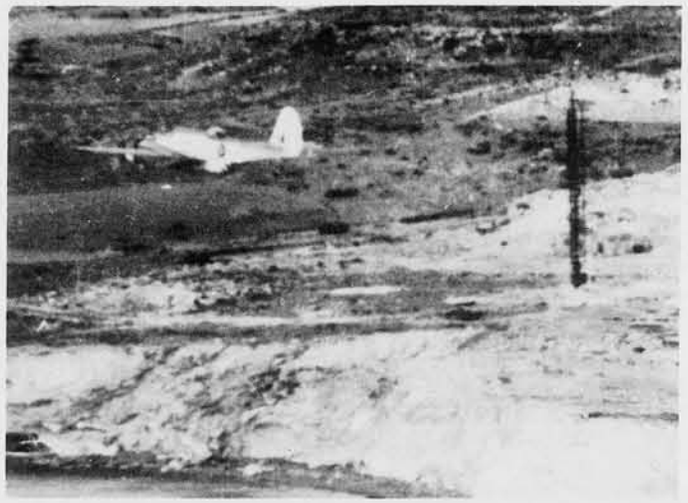


POLE FREYA WITH I.F.F.

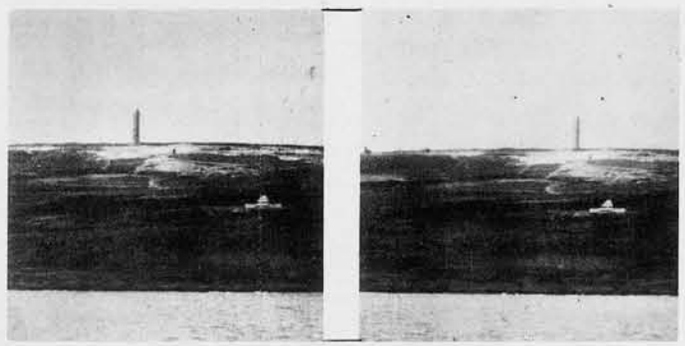
RADAR (GERMAN)

CHIMNEY

On this page are shown two types of Chimney Radar- the Girder type and the Cylindrical type.
The Girder type consists of a triangular or square (in transverse section) girder mast rising out of a short steel column, which is in turn, fitted to a socket on the ground. The radar equipment is in the cabin at the bottom. Steel guy wires secured at the top, assist in supporting. The screen is 19½' wide by 97½' high.
Practical range is 110 Nautical Miles.
Frequency is 120 - 130 Mcs.
The Cylindrical type has a large partly buried concrete casmate, at one end of which is set up a hollow steel cylinder, 130 feet high and 8 feet in diameter surmounted by a crane arm for hoisting frames into position. The screen varies in width somewhat but is likely to be about 60 feet, usually by 97 1/2 feet high.
Both types rotate, are capable of long range reporting, and operate at the same frequency of 120-130 Mcs.
Practical range is 160 Nautical Miles.
Frequency is 120 - 130 Mcs.

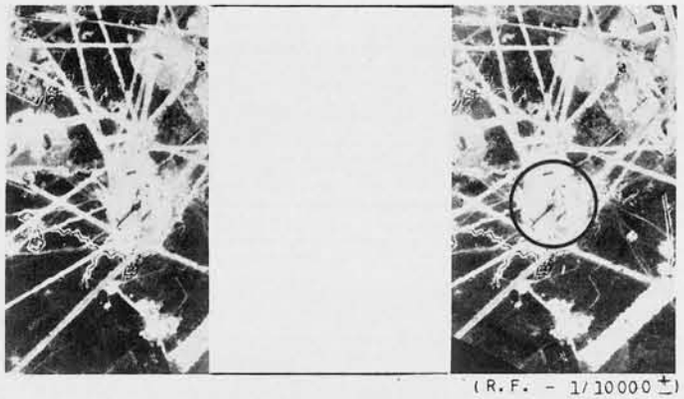


GIRDER CHIMNEY



CYLINDRICAL CHIMNEY

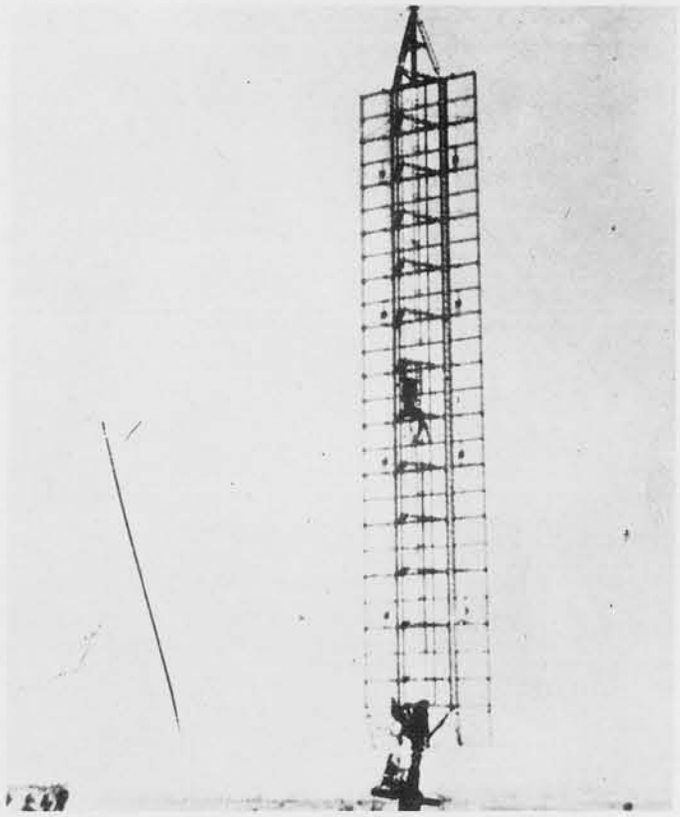
The strong vertical form of cylinder is discernable at long distances.



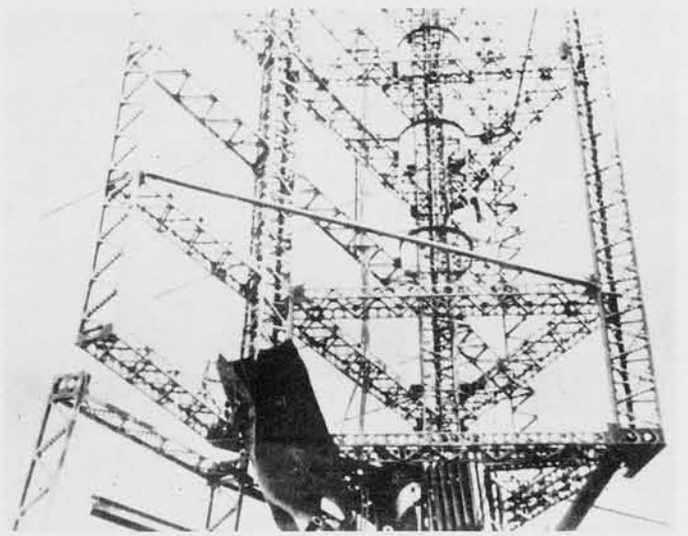
(R.F. - 1/10000 ±)

CYLINDRICAL CHIMNEY

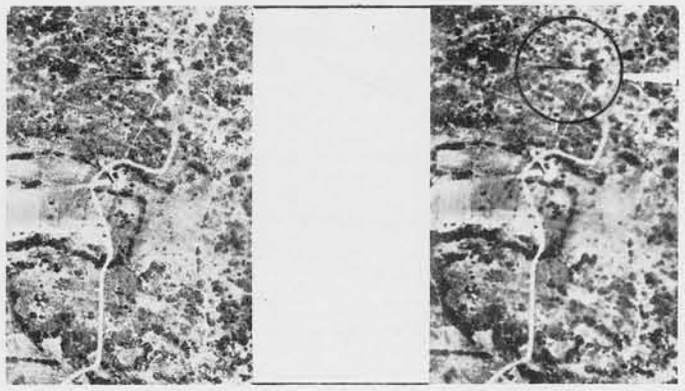
The width of the screen, in vertical view, makes identification comparatively easy.



GIRDER CHIMNEY

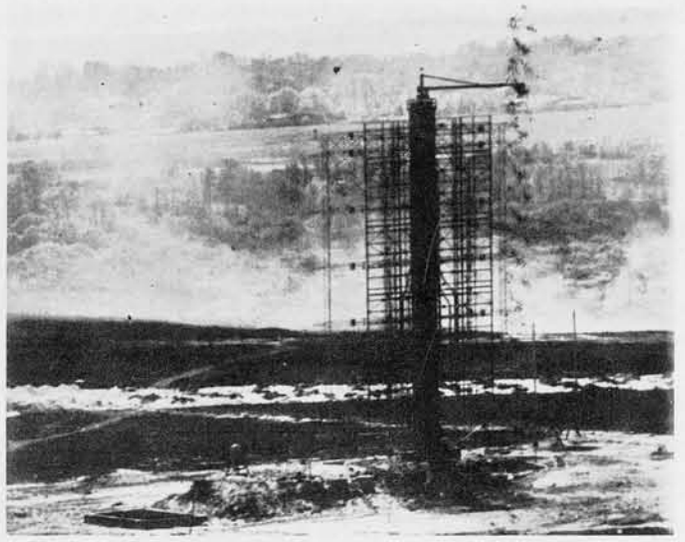


GIRDER CHIMNEY



(R.F. - 1/8000)

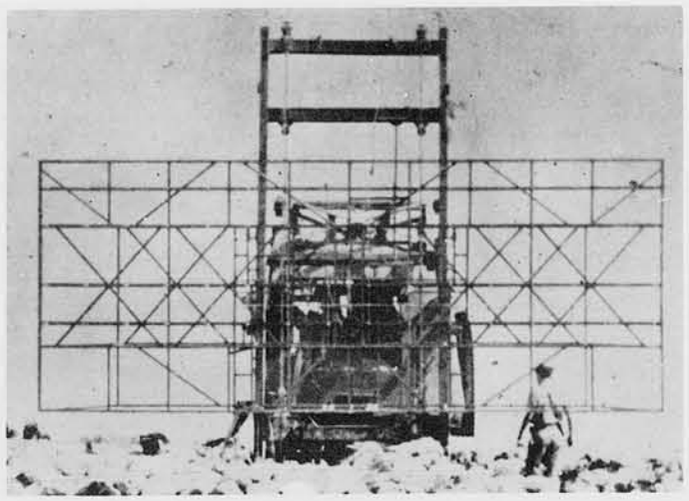
GIRDER CHIMNEY



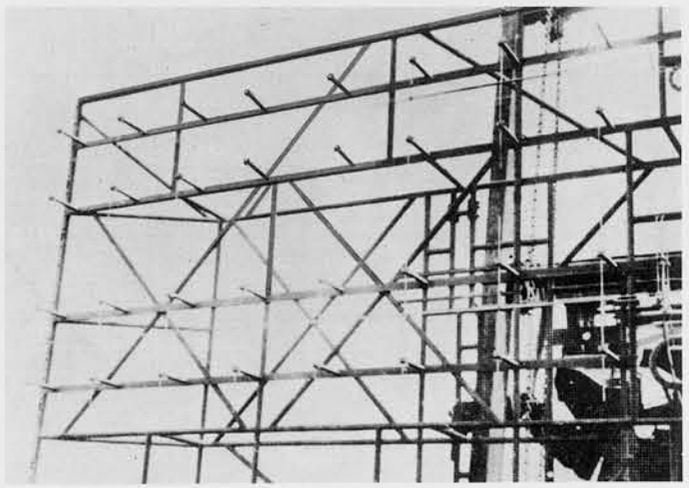
CYLINDRICAL CHIMNEY

RADAR (GERMAN)
COASTWATCHER

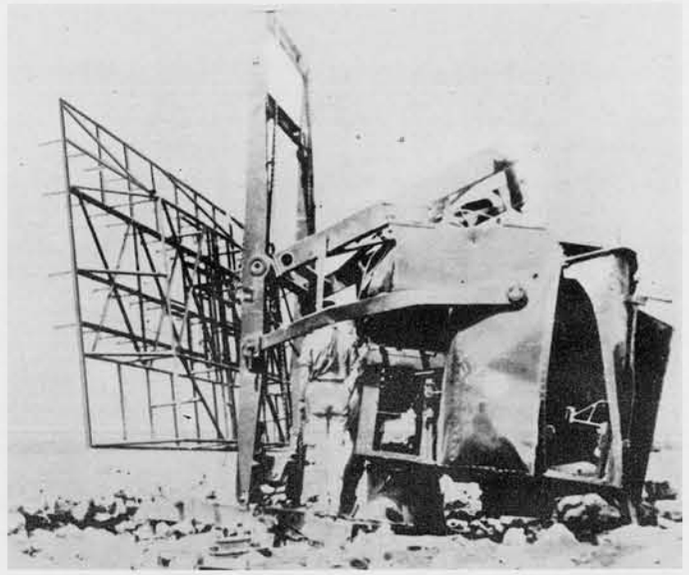
There are two types of German Coastwatcher Radar, the "Gema Coastwatcher" and the "Large Coastwatcher".
The Gema Coastwatcher, shown on this page, is used for detection of ships approaching the coast and for securing range and bearing for fire of coast defense guns.
The aerial is similar to Freya and is 20 feet wide ty 8 feet high. The whole apparatus rotates in azinath.
The aerial is always mounted on limbers, but may be sited on the ground or on top of a building such as the octangonal tower shown on this page.
Range varies with the elevation of the set above sea level. It is 20 Naut. Miles at 250 feet A.S.L.
Frequency is 370 - 390 mcs.



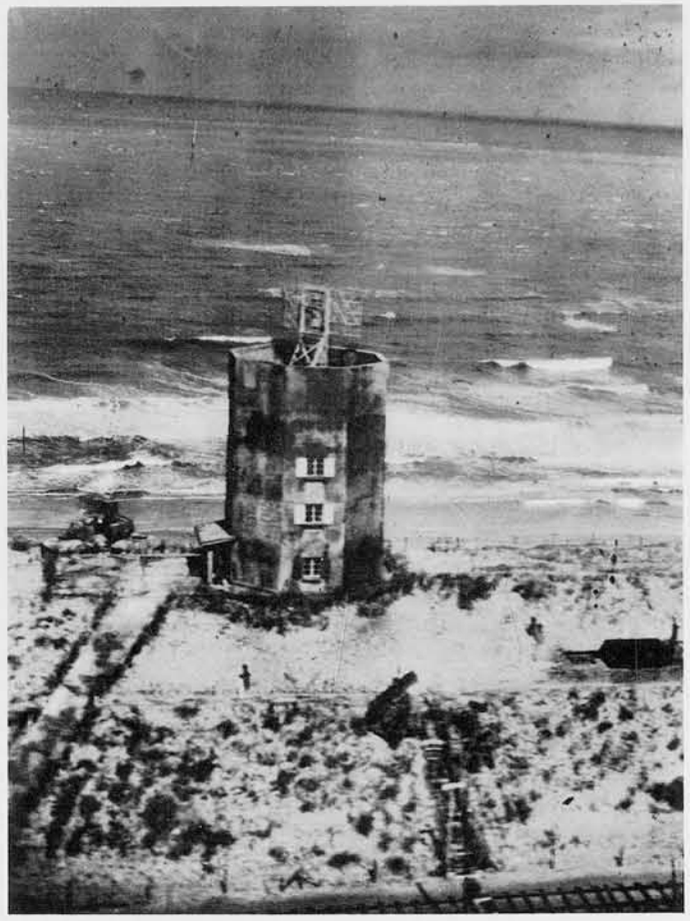
GEMA COASTWATCHER



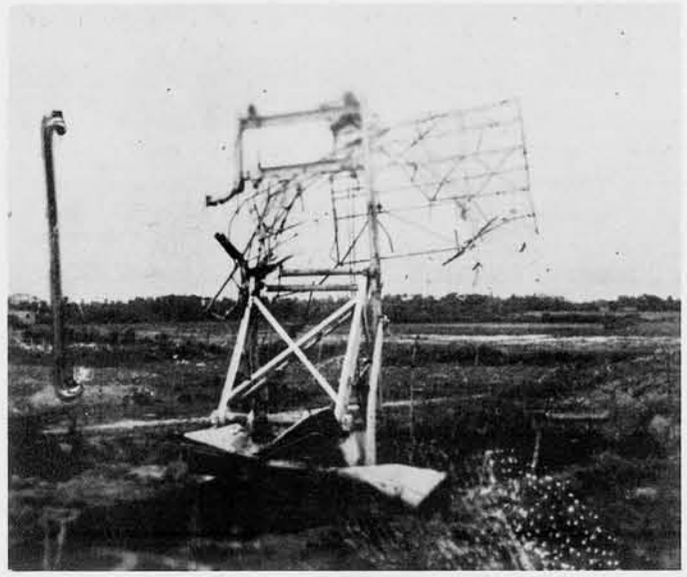
GEMA COASTWATCHER



GEMA COASTWATCHER

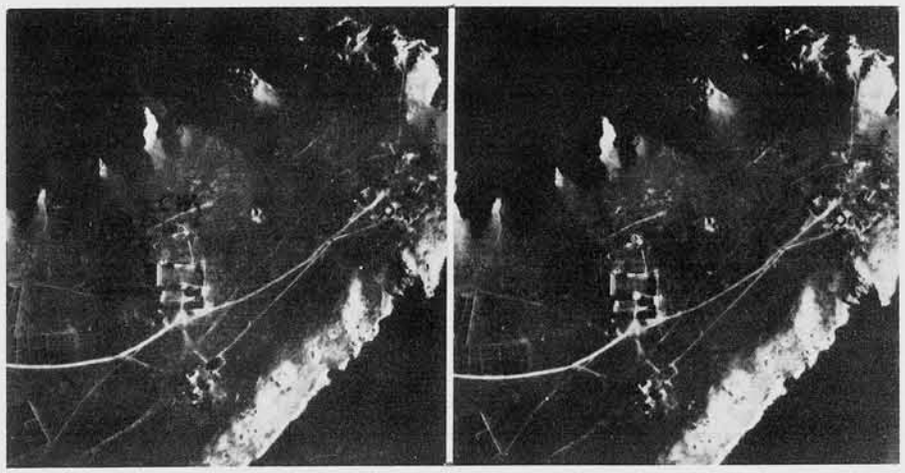


GEMA COASTWATCHER



GEMA COASTWATCHER

GEMA COASTWATCHER



(R.F. - 1/11000±)

GEMA COASTWATCHER

On this page is shown the "Large Coastwatcher" as well as other views of the "Gema Coastwatcher".

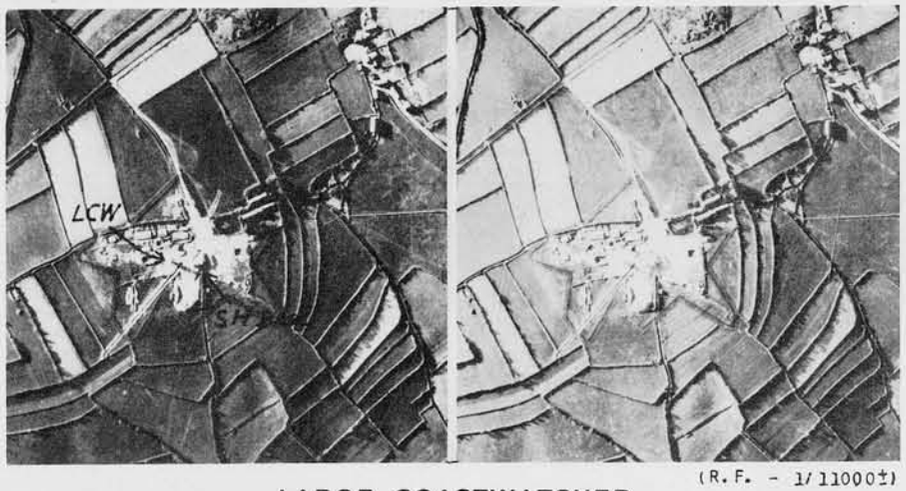
The Large Coastwatcher is a late addition to the list of German Radar, and at the time of the Normandy invasion, little was known in detail concerning its characteristics.

The aerial or screen is nearly square in shape, being 35 feet wide by 34 feet high. The screen and cabin rotate in azimuth.

Its main purpose is the detection of ships.

Practical range of Large Coastwatcher is 60 - 75 nautical miles

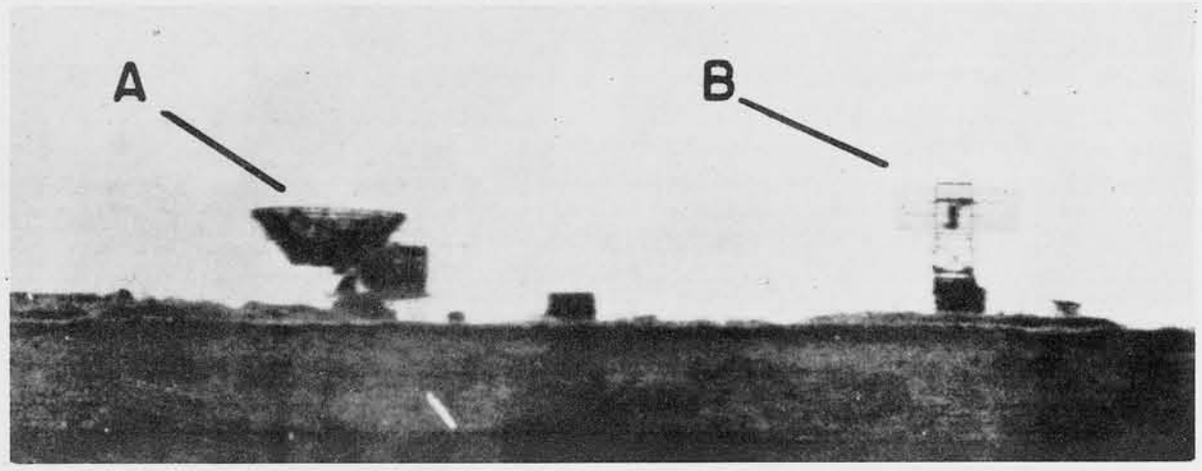
Frequency is 70 - 90 mcs.



(R.F. - 1/11000±)

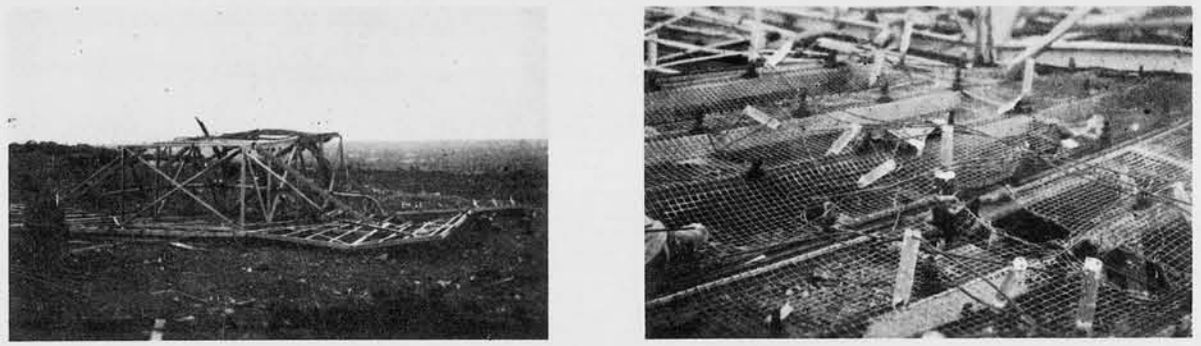
LARGE COASTWATCHER

"LCW"- LARGE COASTWATCHER; "SH" - SMALL HOARDING



GEMA COASTWATCHER

"A" - GIANT WURZBURG; "B" - GEMA COASTWATCHER.



LARGE COASTWATCHER

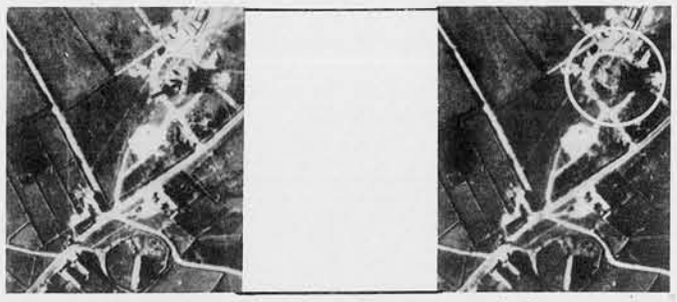
LARGE COASTWATCHER

RADAR (GERMAN)

HOARDING

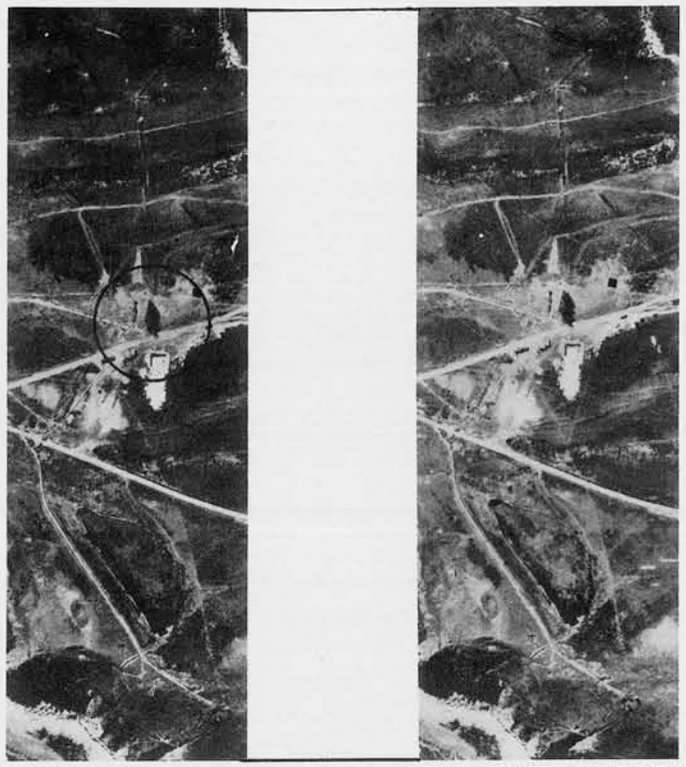
The "Hoarding" apparatus (sometimes called "Mammut") is for long range aircraft reporting, measuring range and bearing. The screen is fixed and is not capable of rotation. Searching is achieved by electrical swinging of the beam. The Large Hoarding consists of a screen 98 feet long by 36½ feet high, looking very much like a billboard. Four heavy vertical girders set in concrete bases give support to the screen. The screen usually consists of two fixed broadside arrays, one attached to each side of the vertical girders.

Practical range of Large Hoarding is 100 - 115 Nautical Miles. Frequency is 120 - 130 Mcs.



(R.F. - 1/11000)

LARGE HOARDING



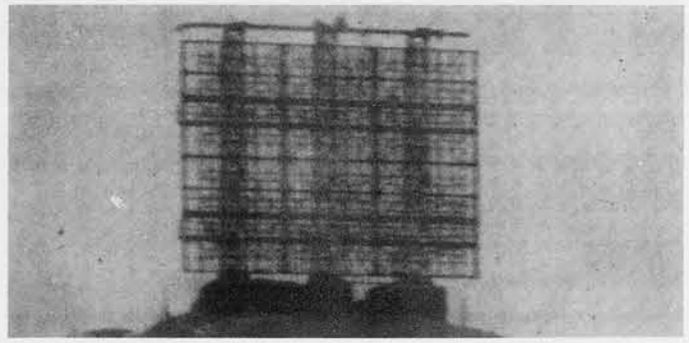
(R.F. - 1/10000)

LARGE HOARDING

A very recent type of German Radar is the Small Hoarding. This apparatus is probably also for coastwatching, and bears a strong similarity to the Large Hoarding, although smaller.

The screen is 63 3/4 feet long by 44 3/4 feet high and is supported by three vertical girders set in concrete bases. The two outside bases are larger than the middle one.

At the top of the vertical girders runs a horizontal rail or bar, which is probably used for hoisting screen into place.

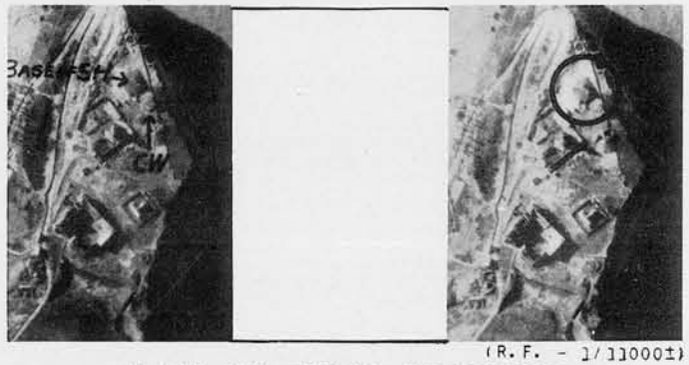


SMALL HOARDING

LARGE HOARDING

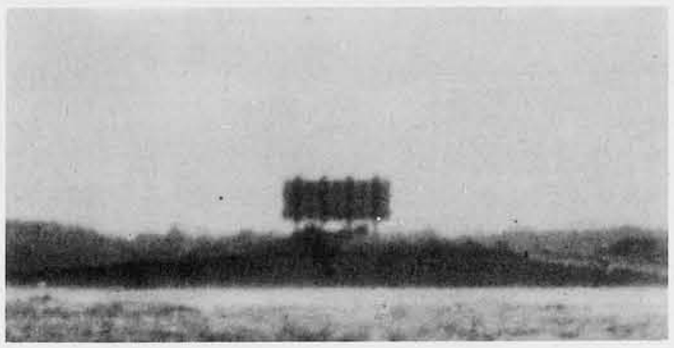
(R.F. - 1/5700)

LARGE HOARDING

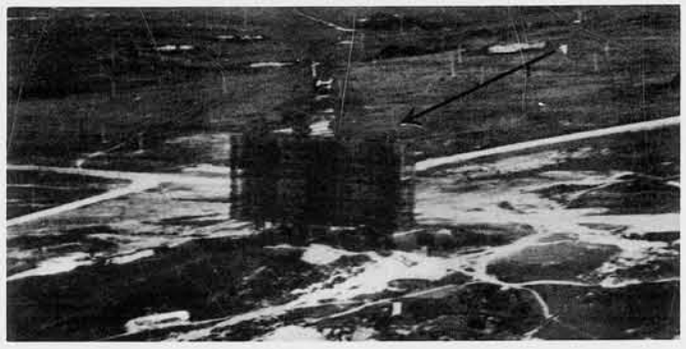


(R.F. - 1/11000±)

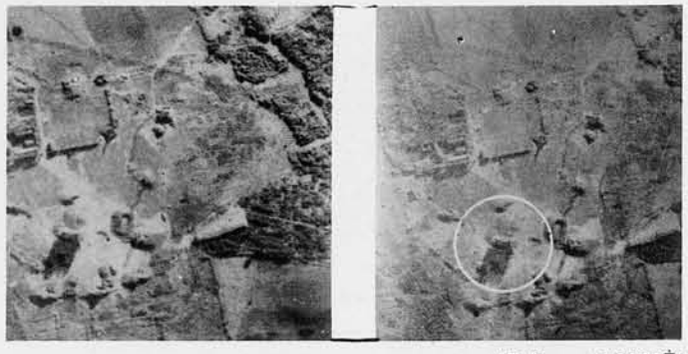
BASE OF SMALL HOARDING



LARGE HOARDING



LARGE HOARDING



SMALL HOARDING (R.F. - 1/9000±)

RADAR (GERMAN)
SMALL WURZBURG

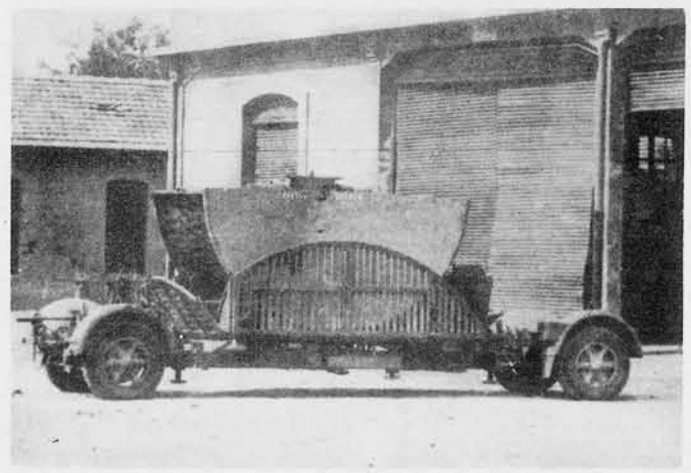
The "Small Wurzburg" or "Bowlfire" was first designed in 1936, and is one of the most efficient Radars. It is primarily for A.A. fire control but has been used for A/C reporting, searchlight control, and as a standby for Ground Control of A/C. In general, it is a mobile Radar, mounted on a four-wheeled trailer with outriggers for levelling. Some sets are emplaced, however, and the wheels removed.

Search is by mechanical rotation of the apparatus for bearing and by elevation of the reflector bowl for height measurement.

The diameter of the paraboloid reflector is 10 feet, the top of which is but 12½ feet above the ground. A cupboard, housing the radar equipment, and an operators seat are attached to the rear and side of the reflector.

There are several types of Small Wurzburgs; among them Types "A", "C", and "D" are most used and are quite similar. Type "D" is found with limber mounting and may be without wheels or even set in concrete.

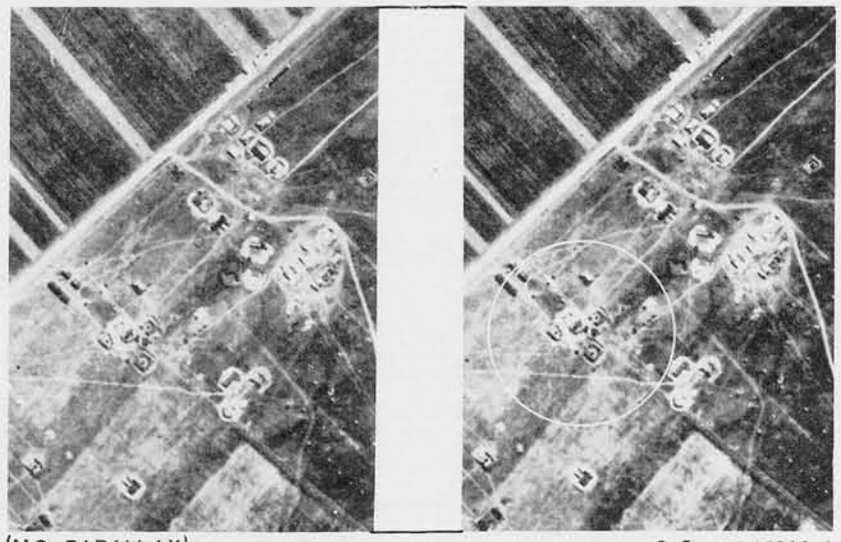
For transport, the paraboloid can be split, by hinges, and turned down in two halves. (See below)



WITH BOWL TURNED DOWN

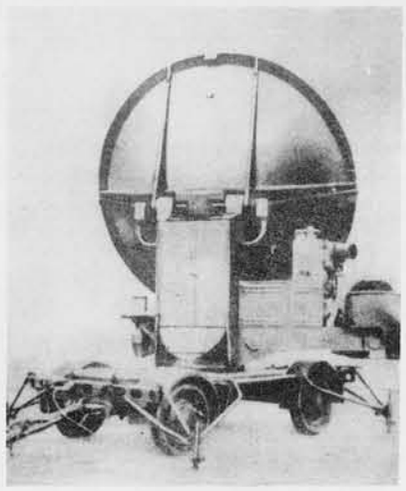
RIGHT: Type F.M.G. 41-T is a modification of the Small Wurzburg which incorporates a scoop-like form for cutting out ground echoes.

The practical range of the Small Wurzburg is not more than 25 nautical miles but it has a high degree of accuracy for Fire Control purposes.

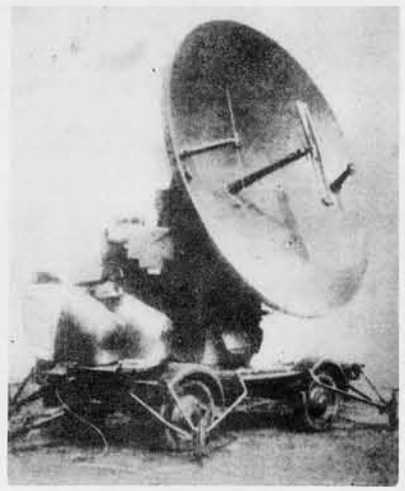


(NO PARALLAX) (R.F. - 1/5000)

TWO SMALL WURZBURGS

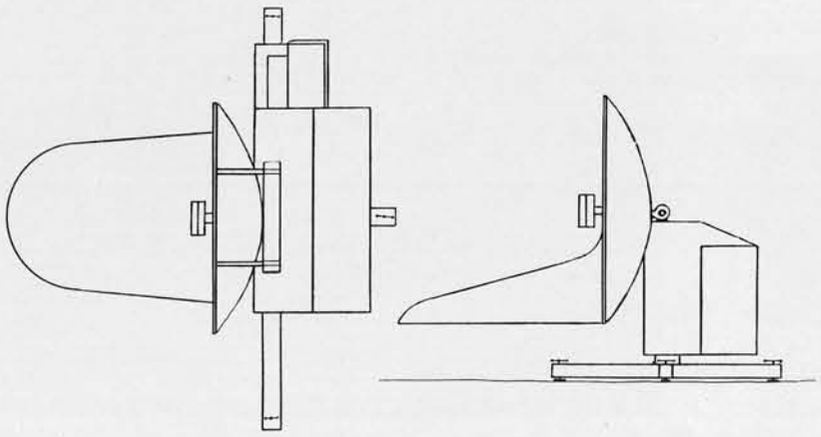


REAR

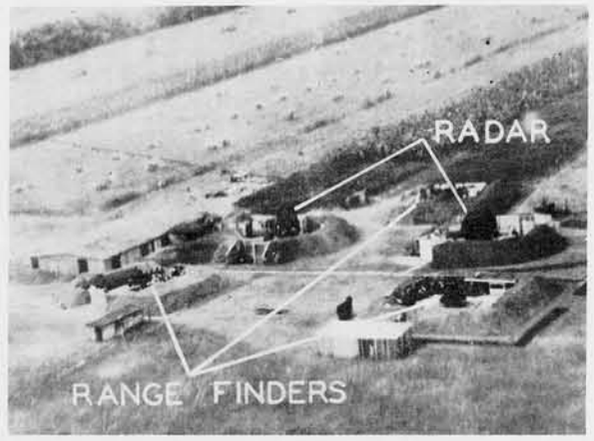


FRONT

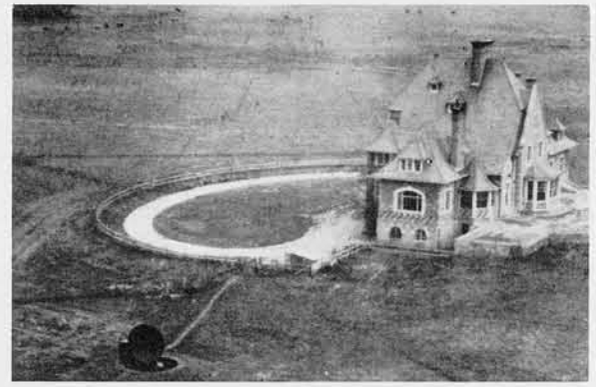
SMALL WURZBURG



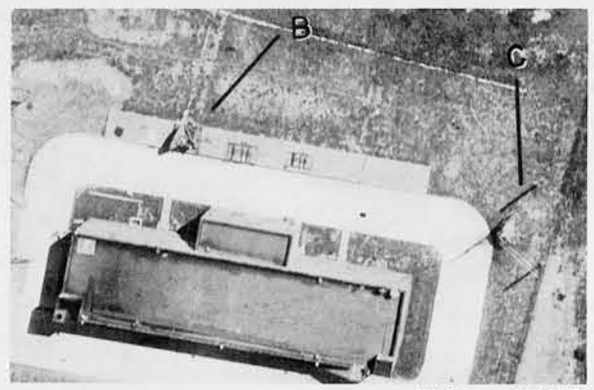
MODIFICATION OF SMALL WURZBURG



TWO SMALL WURZBURGS

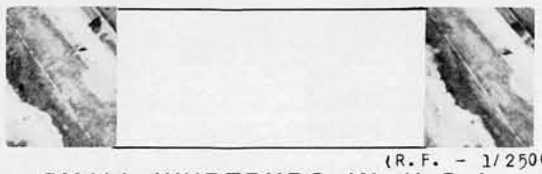


SMALL WURZBURG AT BRUNEVAL



(R.F. - 1/1000)

SMALL WURZBURG IN U.S.A.



(R.F. - 1/2500)

SMALL WURZBURG IN U.S.A.

RADAR (GERMAN)

GIANT WURZBURG

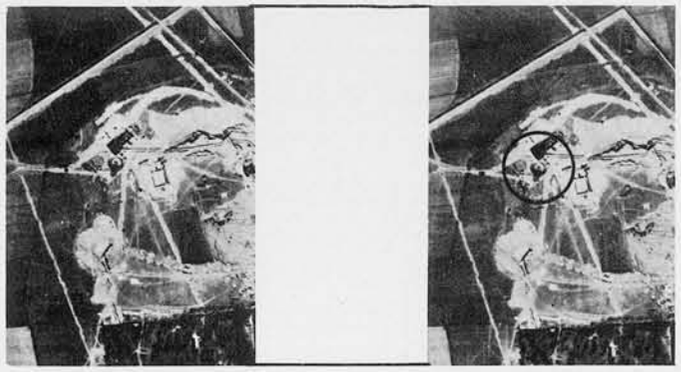
The Giant Wurzburg is a fixed (non-mobile) Radar for measuring range, bearing and height of target aircraft. The whole equipment rotates in azimuth, and the paraboloid tips upward for height finding. Its principal use is for Ground Control Intercept, but some are used for ship-watching.

The basket type metal paraboloid has a diameter of 24 feet.

The large cabin (16' x 10' x 8½' high) rotates with the screen on a turntable which is, in turn, set on a concrete base. In upright position, the top rim of the paraboloid is 27 feet above the ground. An I.F.F. array, consisting of two pairs of dipoles, is located at the top of the paraboloid rim.

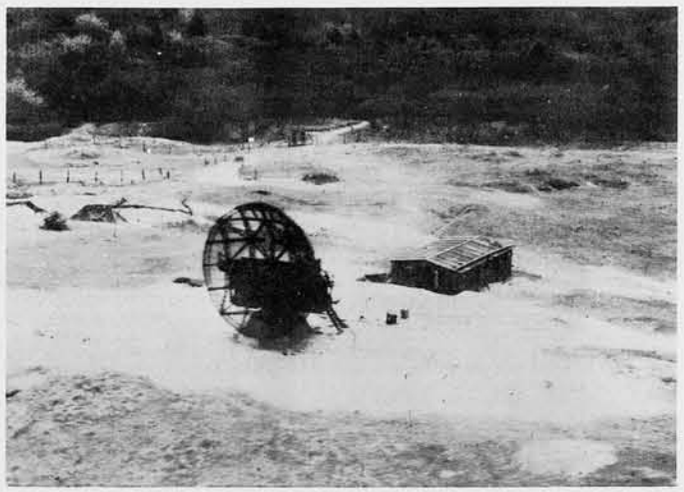
The Giant Wurzburg has been used in great numbers throughout German occupied Europe as a multi-purpose Radar. Practical range of the Giant Wurzburg is 40 N. Mi. Frequency is 470-580 Mcs.

GIANT WURZBURG

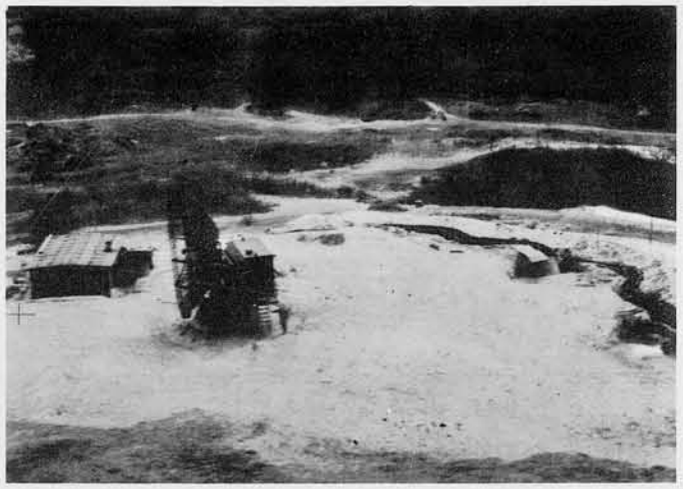


(R.F. - 1/8500)

GIANT WURZBURG

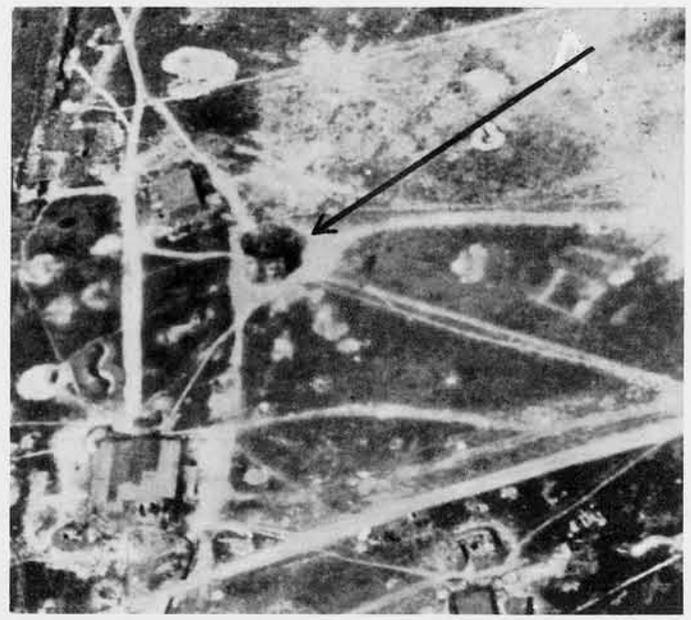


GIANT WURZBURG

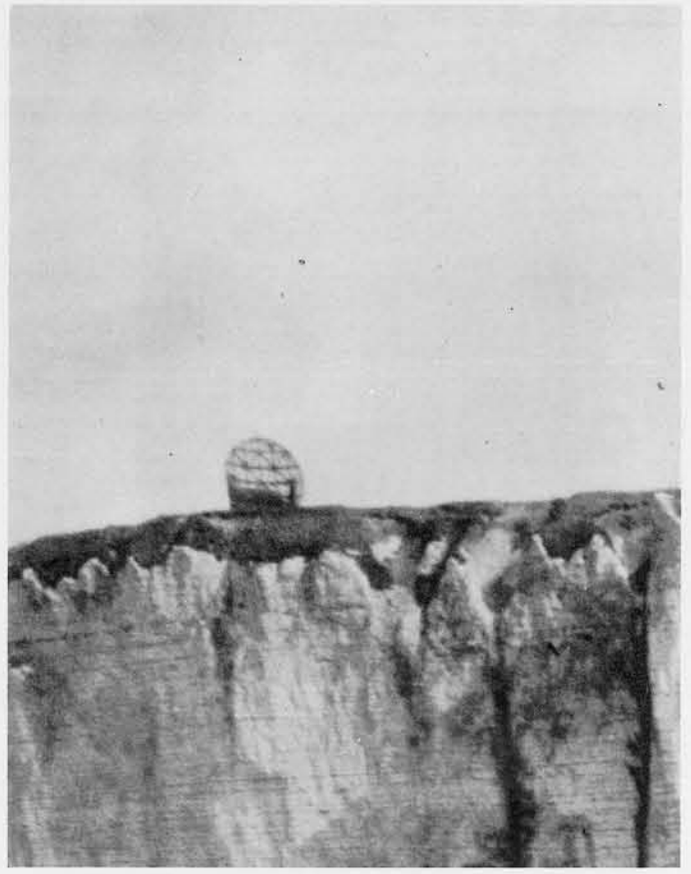


GIANT WURZBURG

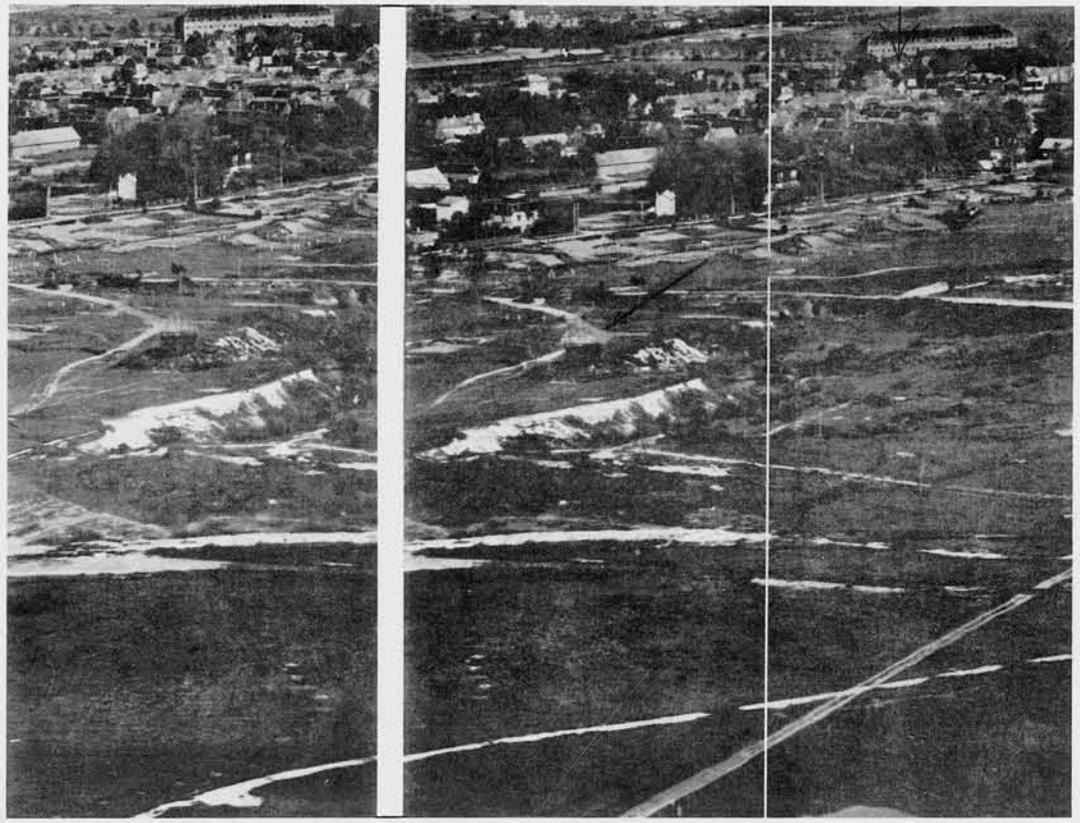
GIANT WURZBURG NEAR COAST



GIANT WURZBURG

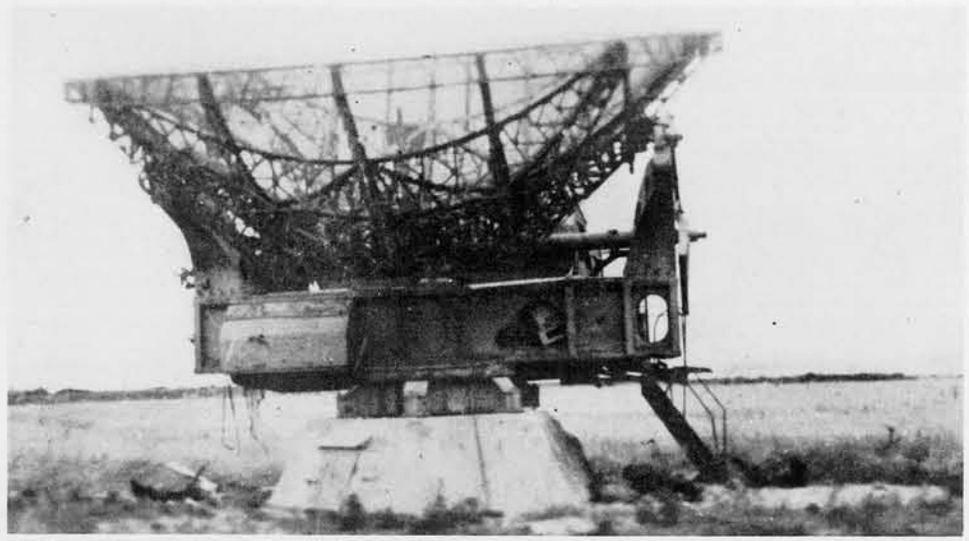


GIANT WURZBURG AS COASTWATCHER

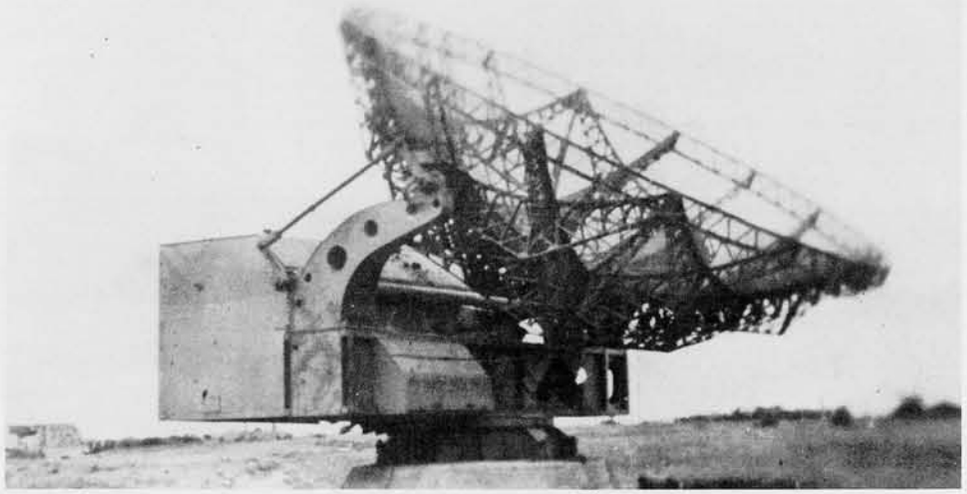


GIANT WURZBURG

Most of these views show the paraboloid of the Giant Wurzburg in uplifted position. The girders are of a light metal alloy. The "Basket" form is used instead of a "Bowl", because of wind resistance offered by such a large surface area.

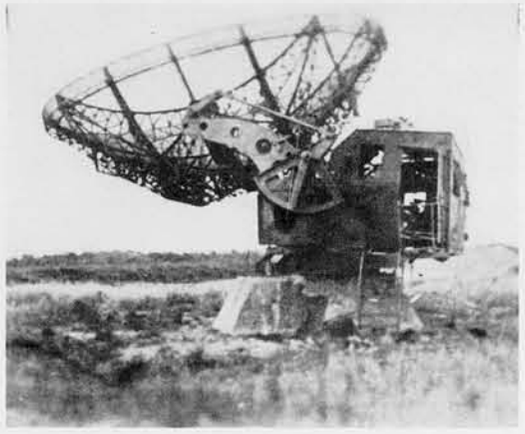


GIANT WURZBURG – FRONT VIEW



GIANT WURZBURG – 3/4 VIEW

GIANT WURZBURG – REAR VIEW



GIANT WURZBURG – SIDE VIEW

G.W. SUPPORTING TRUNNIONS

G.W. I. F. F. ARRAY

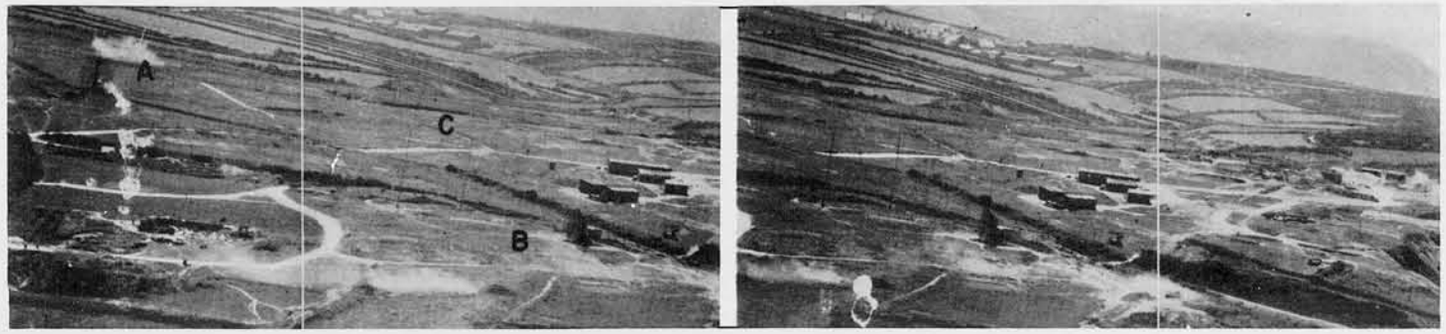
RADAR (GERMAN)
COMBINATIONS

Most German Radar stations, excepting some Hoarding and Chimney sites and a few Ship Watching sites, are provided with several pieces of equipment.

The most common station, the Coastal Early Warning Station, usually has two Freyas and one or two Wurzburgs. The Freyas are in circular emplacements.

The typical G.C.I. station has two Giant Wurzburgs, one Freya, and occasionally a Small Wurzburg.

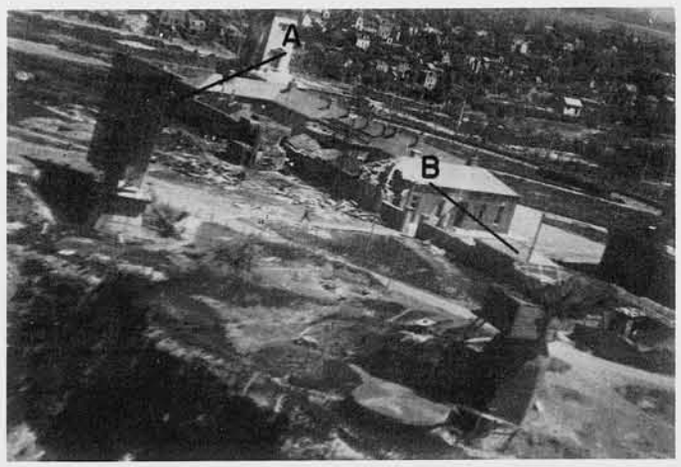
Ship watching stations have one Coastwatcher and a Small or Giant Wurzburg.



RADAR STATION - FRANCE

"A" - POLE FREYA; "B" - GIANT WURZBURG; "C" - RADIO COMMUNICATIONS

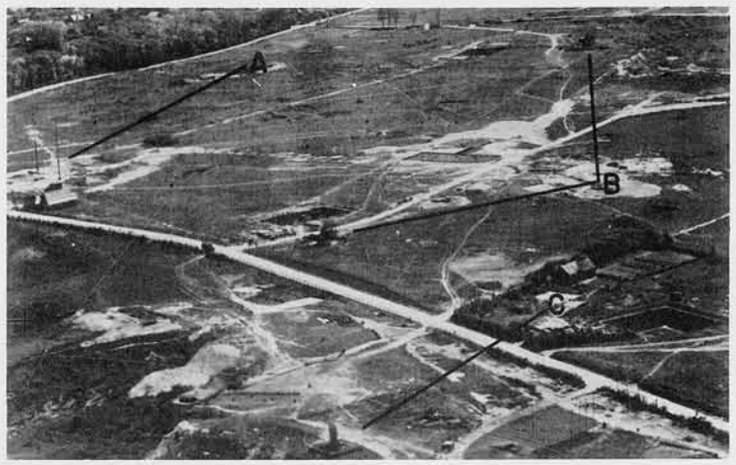
Large Radar Stations such as these have not yet been seen in the Japanese war. However, these examples indicate how well-organized Early Warning and Ground Control Intercept stations may appear.



RADAR STATION - FRANCE

"A" - LARGE COASTWATCHER

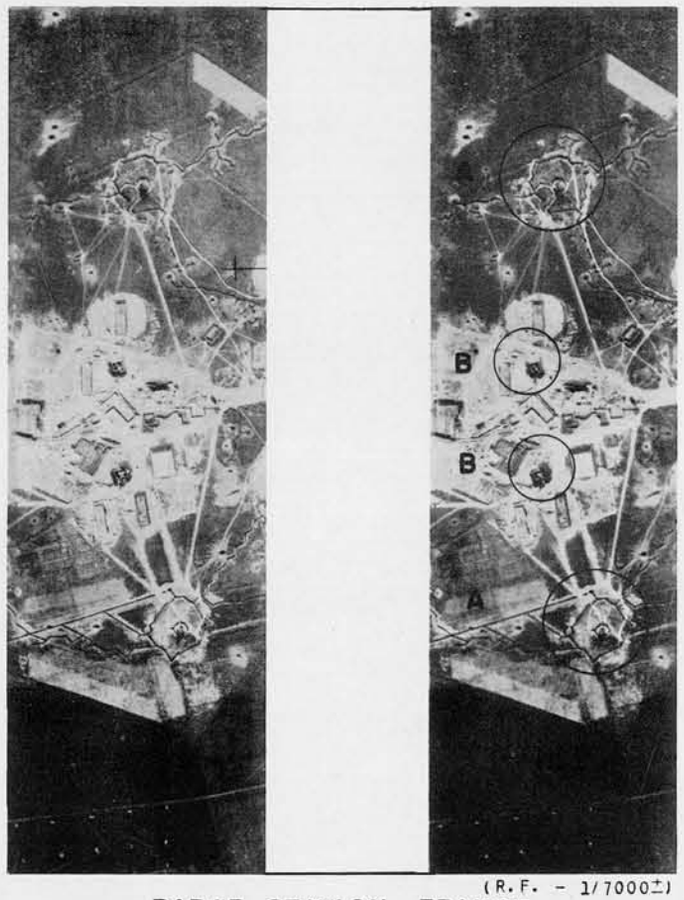
"B" - GIANT WURZBURG



RADAR STATION - FRANCE

"A" - RADIO COMMUNICATIONS "C" - POLE FREYA

"B" - 2 GIANT WURZBURGS

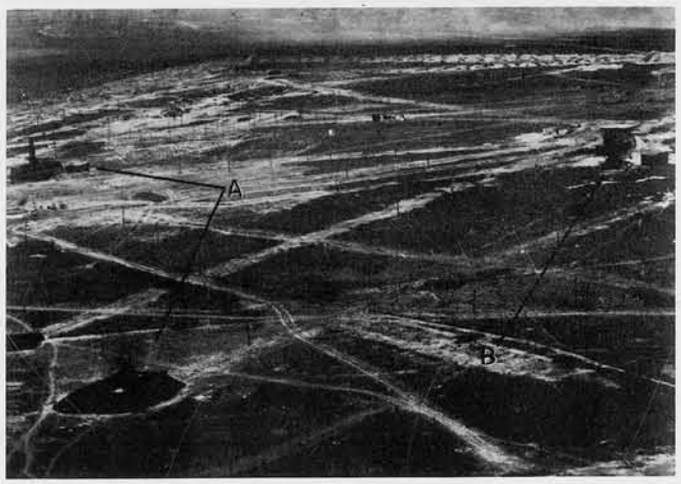


(R.F. - 1/7000±)

RADAR STATION - FRANCE

"A" - 2 GIANT WURZBURGS

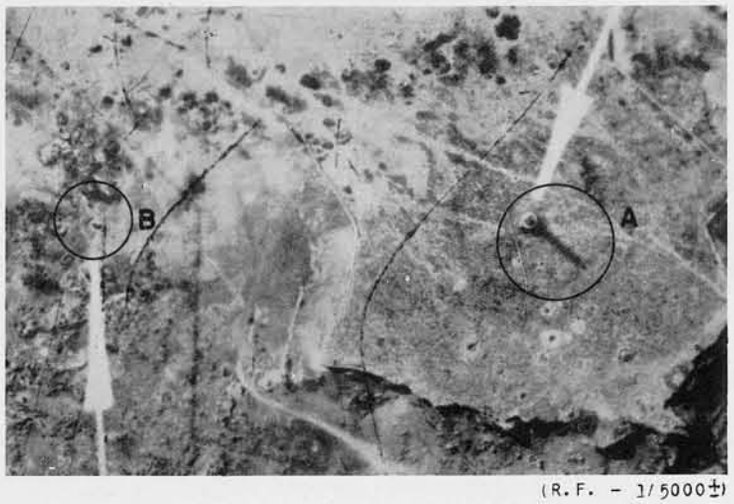
"B" - 2 LIMBER FREYAS



RADAR STATION - FRANCE

"A" - 2 LIMBER FREYAS

"B" - 1 GIANT WURZBURG

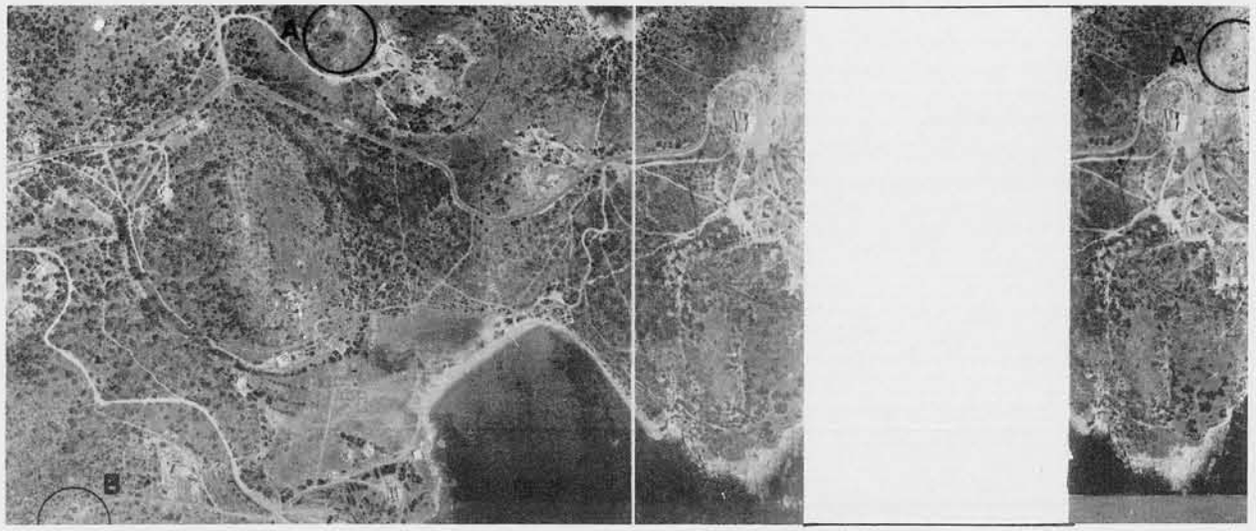


(R.F. - 1/5000±)

RADAR STATION - CRETE

"A" - GIRDER CHIMNEY

"B" - SMALL WURZBURG



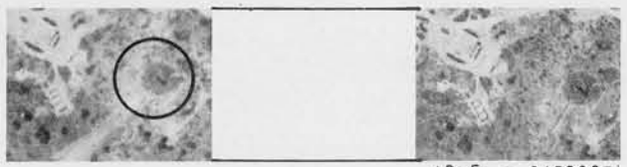
(R.F. - 1/10000±)

RADAR STATION - GREECE

"A" - 2 LIMBER FREYAS; "B" - GIANT WURZBURG

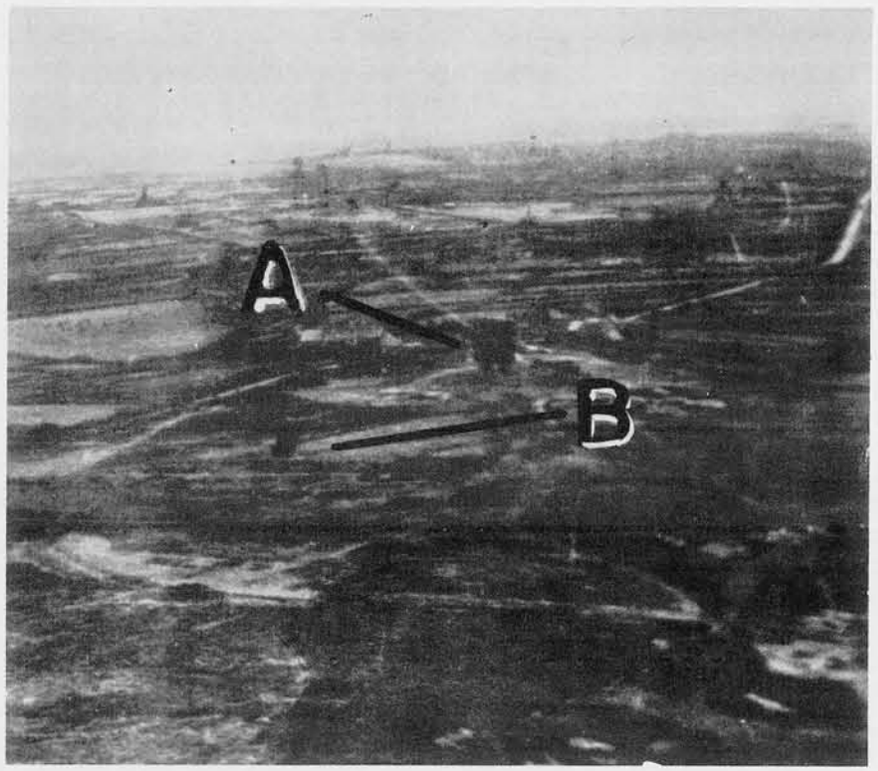
(R.F. - 1/5000±)

GIANT WURZBURG



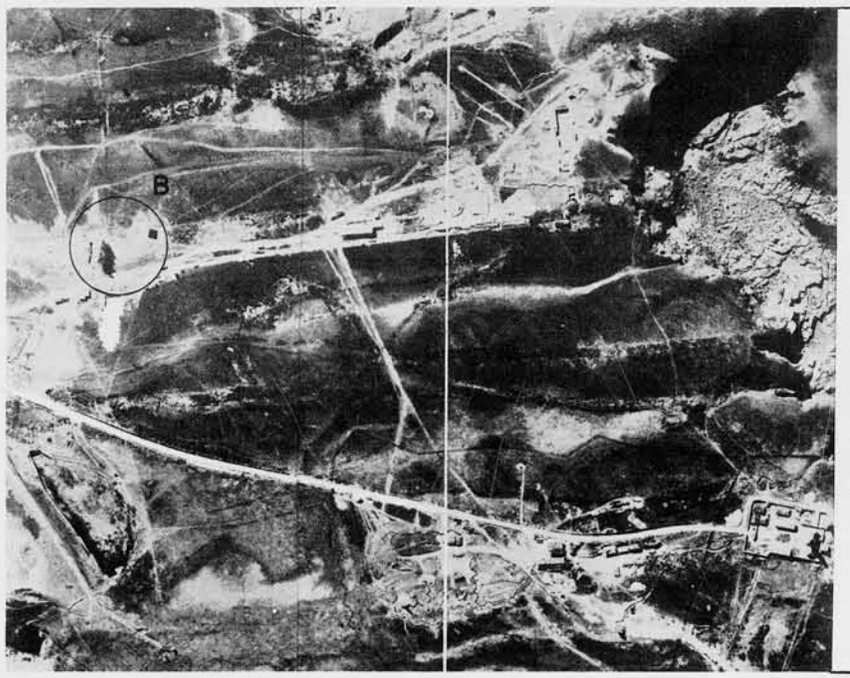
(R.F. - 1/5000±)

LIMBER FREYA



RADAR STATION - FRANCE

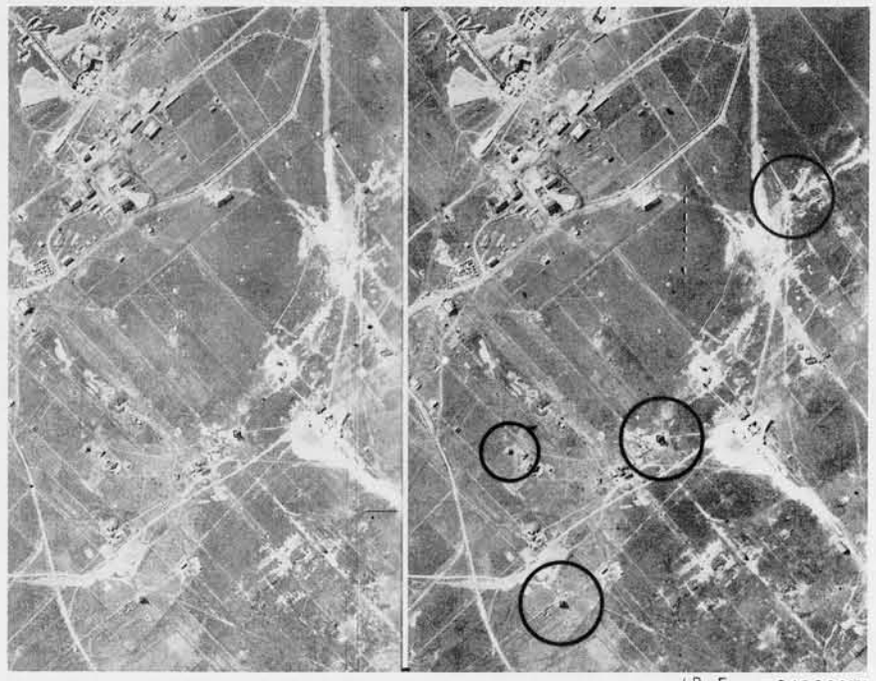
"A" - LARGE HOARDING; "B" - GIANT WURZBURG



(R.F. - 1/10000±)

RADAR STATION - FRANCE

"A" - 2 GIANT WURZBURGS; "B" - LARGE HOARDING



(R.F. - 1/8000±)

RADAR STATION - FRANCE

"A" - 2 GIANT WURZBURGS; "B" - FREYA; "C" - SMALL WURZBURG

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL

SECTION-2

2.01 — 2.99

COMMUNICATIONS

CONFIDENTIAL

ALLIED STANDARD FREQUENCY TABLE

SUPER HIGH FREQUENCY (MICRO-WAVE)	3000 - 30,000 Mcs.
ULTRA HIGH FREQUENCY	300 - 3,000 Mcs.
VERY HIGH FREQUENCY	30 - 300 Mcs.
HIGH FREQUENCY	3 -30 Mcs.
MEDIUM FREQUENCY	0.3 - 3 Mcs. (300-3000 Kcs.)
LOW FREQUENCY	0.03 - 0.3 Mcs. (30-300 Kcs.)
VERY LOW FREQUENCY	0.01 - 0.03 Mcs. (10-30 Kcs.)

Frequency bands of Radio Communications Stations do not fall exactly into the breakdown listed above. Also, it is impossible to determine exact frequencies by means of photographic interpretation alone.

To prevent confusion, the following system is used in this report:

If it is thought that the frequency band of a station overlaps the divisions listed in the standard breakdown, the dominant frequency will dictate the frequency band as called for in the above table.

For example, if a transmitter will operate from 300 to 600 Kcs., it will be called "Medium Frequency" for purposes of classification because 3/4 of this frequency band of 400 Kcs. (or 300 Kcs.) falls into the standard "Medium Frequency" division.

Many standardized Japanese Communication Centers, utilizing three 75 foot high steel lattice masts, are believed to fall in this catagory. They may be more exactly referred to as being fairly powerful Low-Medium Frequency stations with reliable ranges of greater than 500 miles.

When a station is catalogued as being of a certain frequency, the classification also presumes the possibility of another transmitter being present, operating at higher frequencies. However, the general classification of the station is still derived by an estimate of its dominant lowest frequency.

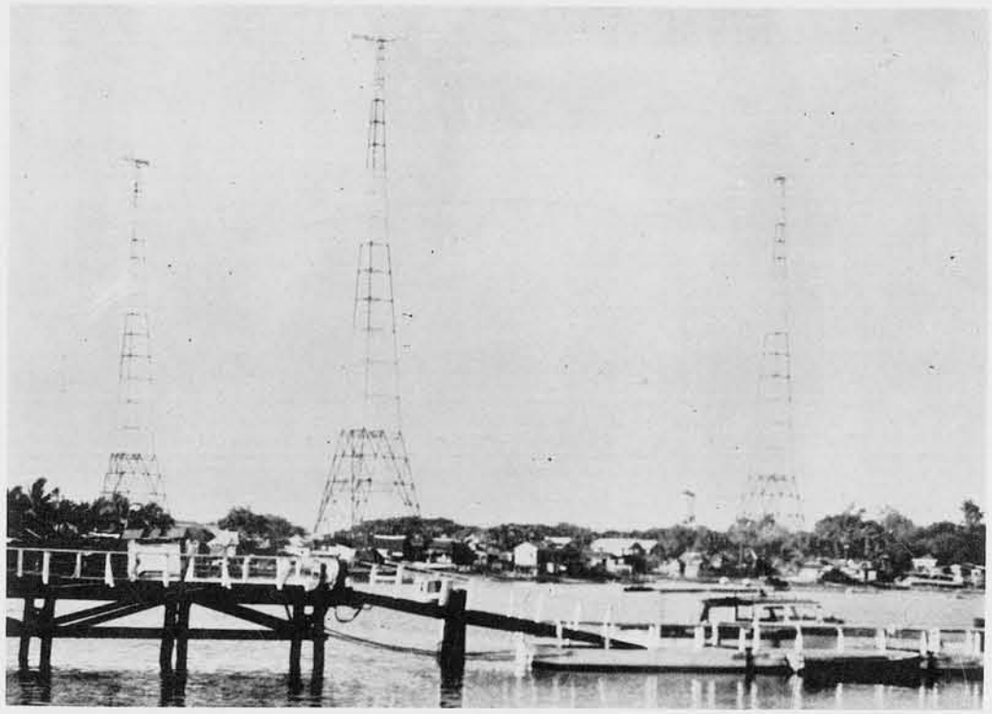
COMMUNICATIONS
SUMMARY

Radio communication plays a very important part in the Japanese military system and has been developed to a great extent, both in quality and quantity. German technical skills are known to have contributed to the former, and for years the Japanese themselves have been building an elaborate communications network throughout their widely dispersed empire.

The problem of interpreting radio communications installations correctly and precisely is more complex than with other electronics equipment, even though the installation may often be catalogued as "radio" at a glance.

Apparently conscious of their "Achilles heel" of communication, the Japanese have followed a policy of duplication of installations, multi-frequency setups, camouflage, well protected power plants etc. A typical coral atoll, for example, will contain three or four large stations operating over hundreds of miles, and countless small stations, difficult to spot on aerial photographs.

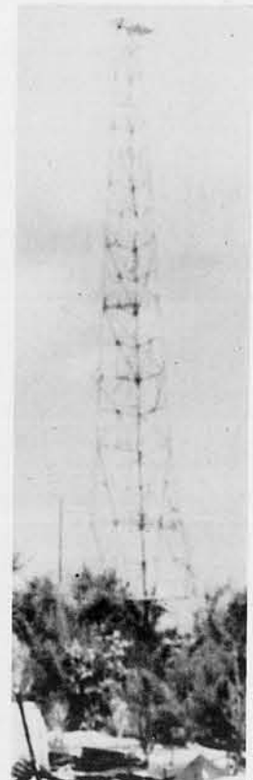
In addition to these are well made semi-portable and portable transmitters and receivers,& hand-held walky-talkies. Also, weather stations, communications auxiliary to D. F. installations, and Radio ships.



PHILIPPINES

This U.S. station in the Philippines is more powerful than is likely to be found in most Japanese controlled areas. At the present time the mast at the far left is missing. However, the enemy is thought to be using the two remaining masts in connection with a station now operated by them. These are called "lattice masts" and are 600' high, with a spread at the base of 125' or more. Masts of Japanese design, found to date, are usually not over 350' in height.

SAIPAN, MARIANAS



SAIPAN

TINIAN, MARIANAS

(R.F. - 1/5000)

TINIAN, MARIANAS

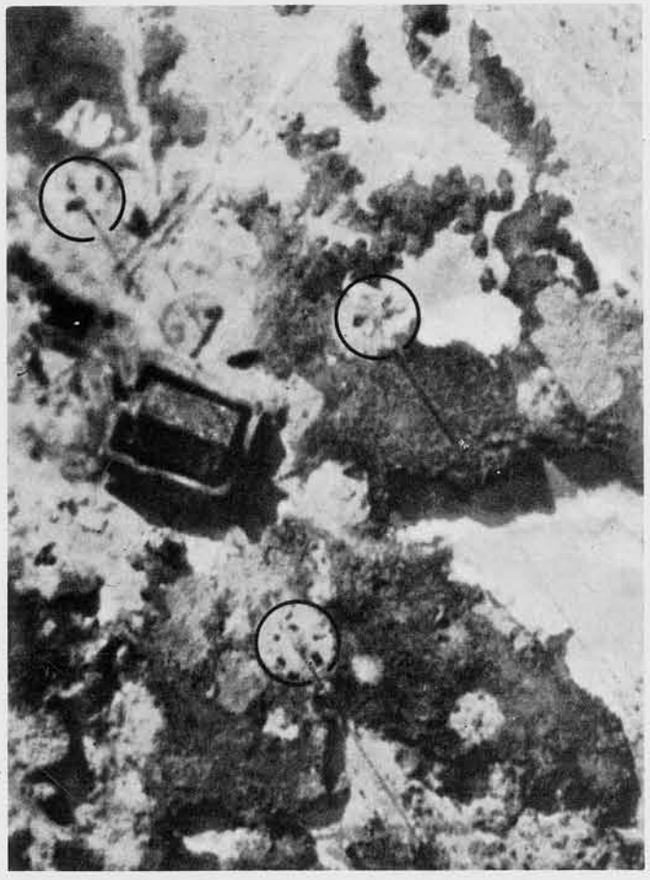
CONFIDENTIAL

COMMUNICATIONS

SUMMARY (CONT.)

In this section an attempt has been made to treat more exactly than heretofore, the interpretation of fixed radio installations, based solely on features that can be seen by the Photographic Interpreter.

In that antennae can seldom be seen on aerial photos, masts are of primary importance in interpreting radio communications. In vertical photos mast location, type and height can often be determined by the shadows they cast on the ground.



(R.F. - 1/2000)

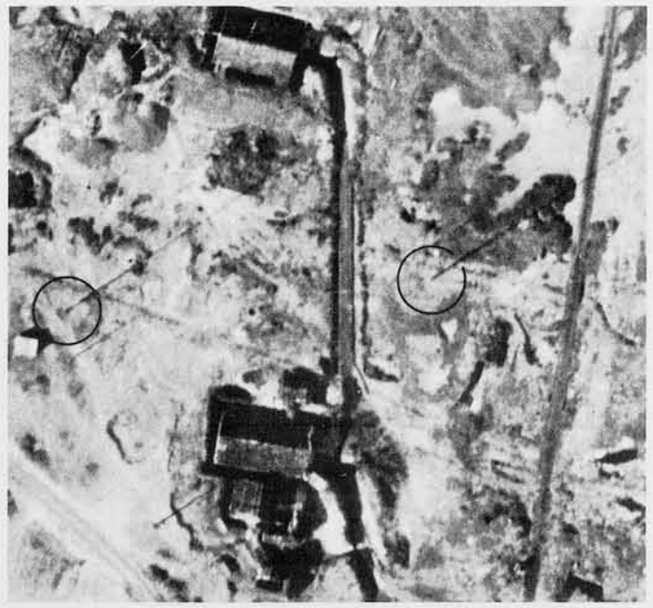
KISKA

ABOVE: In this view of a 3 mast Kiska station, the masts would not be visible were it not for the shadows cast by them.

The masts usually surround, or are close to the transmitting building.

RIGHT: Antennae and lines supporting masts are barely visible here at an elevation of 100 feet. Few pictures afford this amount of detail, however.

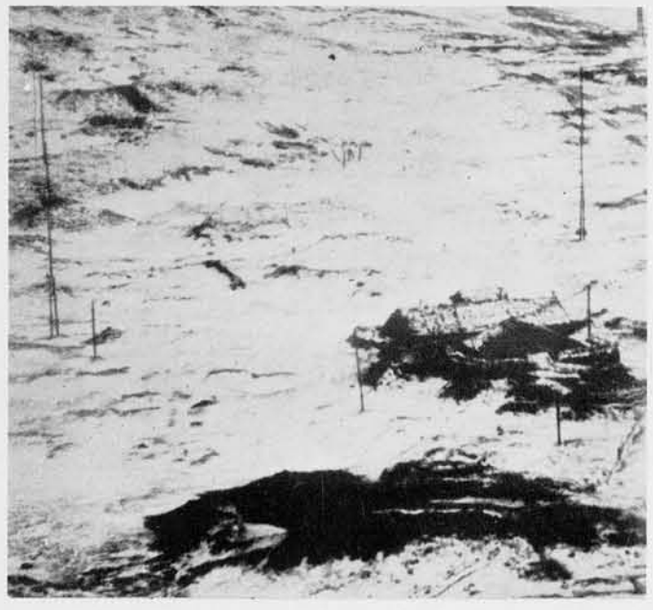
BORAM, NEW GUINEA



(R.F. - 1/2000)

KISKA

ABOVE: This 2 mast Kiska station contains 75' spliced wooden masts and smaller power line poles crossing diagonally at lower left of picture.



KISKA

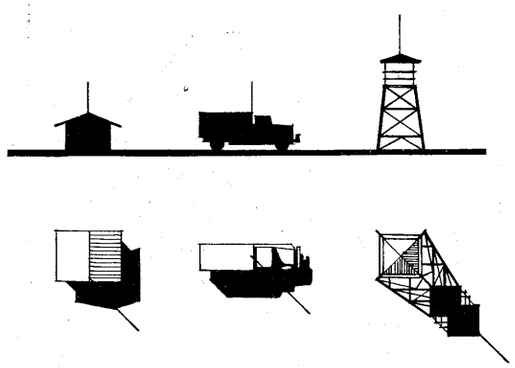
ABOVE: Low oblique of masts and poles. This spliced mast design is usually 75' high and is a favorite of the Japanese.

COMMUNICATIONS
SUMMARY (CONT.)

On this page are shown examples of the various mast designs in use by the Japanese. Shadow patterns are indicated to stress the importance of this method of interpretation.

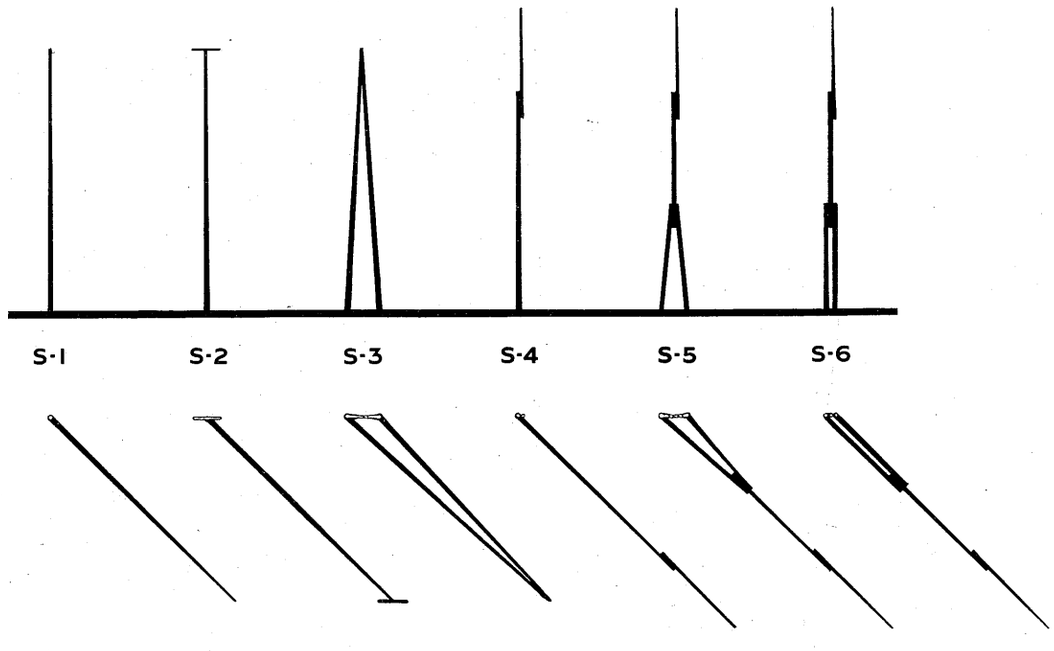
WHIP MASTS

There are many other types and locations in connection with portable, mobile, ship and aircraft equipment, which are usually impossible to interpret adequately in small scale vertical photography.



STICK MASTS

Below are shown six designs of stick masts found in Japanese areas. With the exception of S-1 and S-2 these are generally between 50 feet and 75 feet in height. S-5 and S-6 are usually 75' high. With good photography it is often possible to determine exact design, even at fairly small scale.

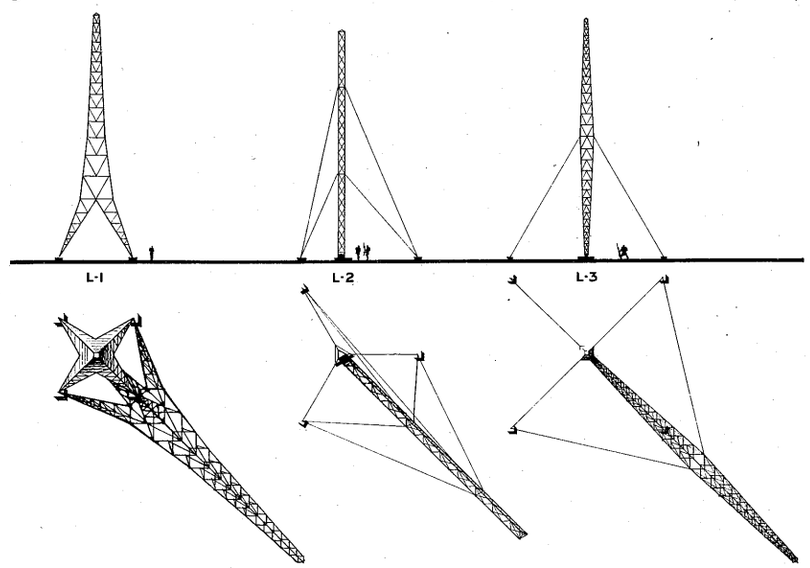


LATTICE MASTS

A great variety of designs occurs in lattice type masts. They are usually of steel construction with prefabricated members. The following diagrams show certain basic types which are frequently found with enemy installations.

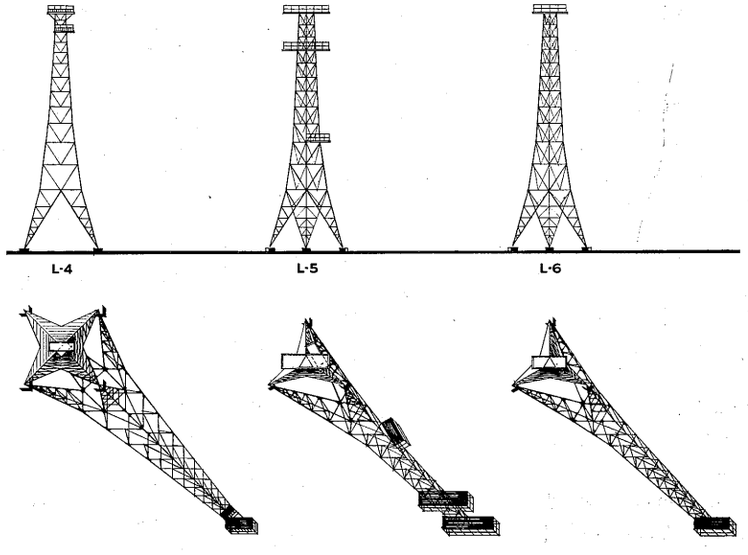
L-1, L-2, and L-3 are more typical of occidental design, and often indicate pre-war broadcast stations.

Lattice masts may range in height from 60 feet to 600 feet with the majority falling between 75 feet and 300 feet.



PLATFORMS

Lattice masts with Japanese military radio stations usually have platforms as indicated below. L-5 is likely to be found in threes and is normally 75 feet high.



COMMUNICATIONS

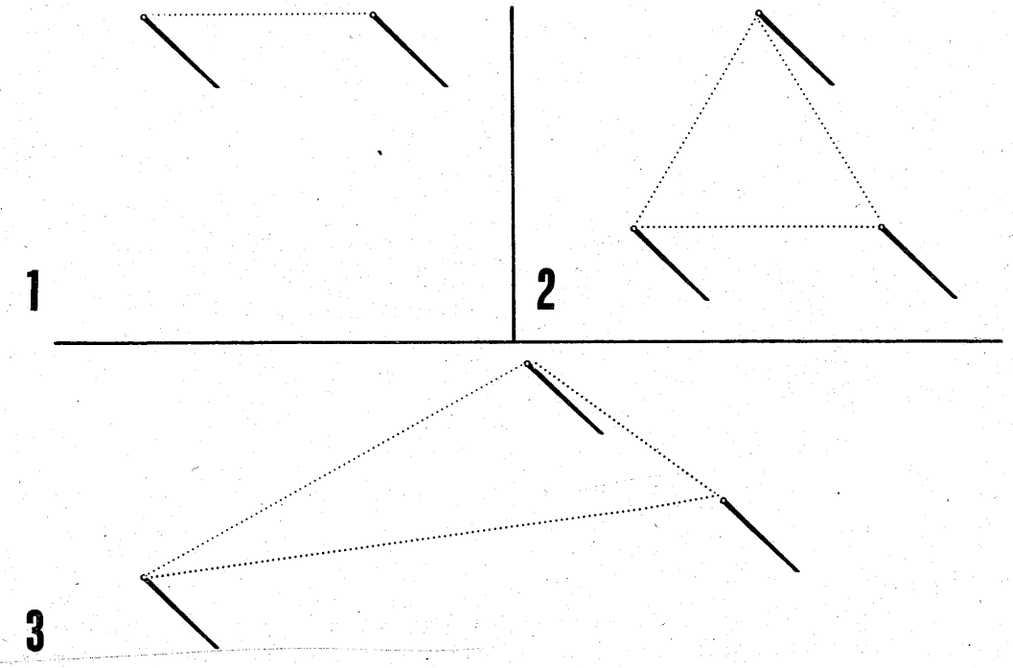
SUMMARY (CONT.)

MAST PATTERNS

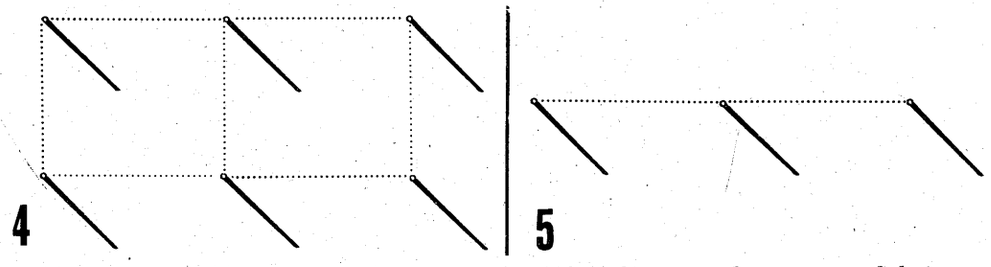
Patterns in vertical photographs are important insofar as they indicate directional capacities and probable use. Certain directional patterns of masts indicate Direction Finding or Navigational Aids, which removes the installation from the category of communications.

A single mast is non-directional.

Note: Dotted lines are to show form of pattern and do not necessarily represent location of antennae. Arrow indicates direction(s) of radio "beam".

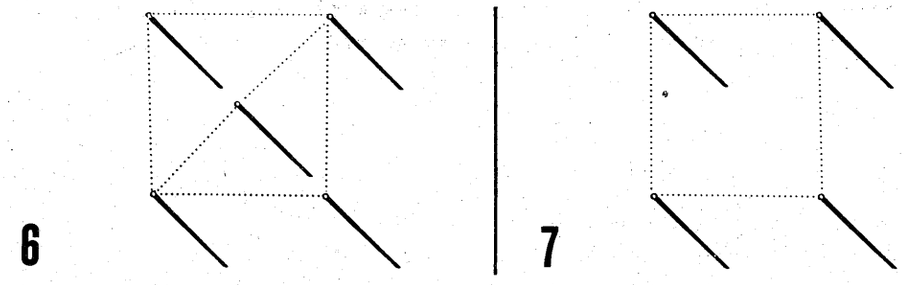


Patterns #1, #2, and #3 represent non-directional Radio Communications. Although it may be possible to achieve directivity from these patterns, particularly #1, they are much more likely to be used for non-directional communications and constitute the most frequently found patterns for communication stations.



Pattern #4 usually represents a non-directional array for a powerful transmitter. However, it can be directional (on long or short axis) if spaced and fed for that purpose.

Pattern #5 can represent directional high frequency transmission, if masts are spaced close together (½ wave length).



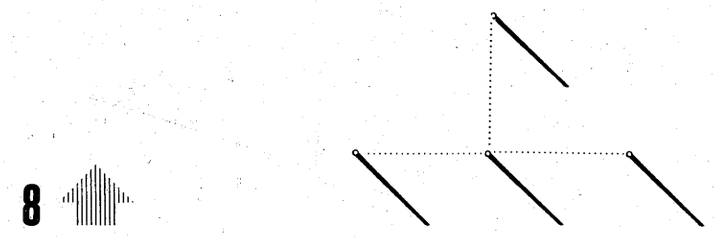
Patterns #6 and #7 are examples of arrangements that are likely to create difficulties in interpretation:

#6, with a diagonal dimension of approximately 600 feet is likely to be a radio range station capable of sending a navigational beam in any prescribed direction. This is not a communications pattern.

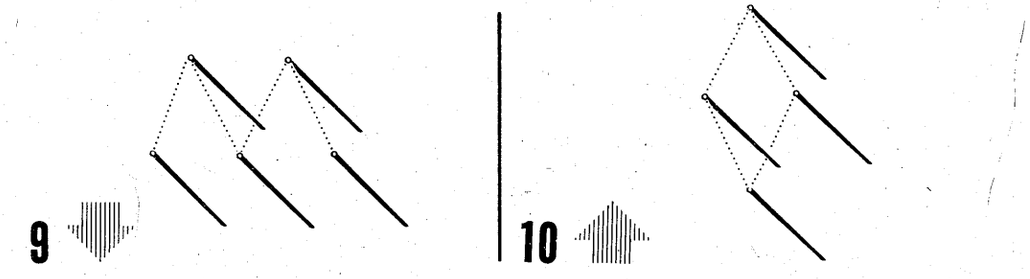
#7 is either a communication station pattern or a direction finder pattern.

(a) If Communications, the size will be a clue. The diagonal dimension will then be from several hundred to two thousand feet. Large auxiliary buildings, housing transmitter, power house, offices and personnel quarters will be visible.

(b) If a Direction Finder, the diagonal dimension will be approximately 100 feet. In Japanese design there is likely to be a small shack in the exact center of the pattern, but this is not absolutely necessary. Diagonal underground cables are usually visible.



Pattern #8 represents a communications station which may be directional as shown by arrow.



Pattern #9 used singly or repeated may indicate a navigational aid, either for ships or aircraft. Such an arrangement is also used for intercept purposes; for directional communication, 2 masts may be at point of "V".

Pattern #10 indicates directional communications and is called a "rhombic" pattern. It usually occurs in multiple units, radiating from a central point.

Such a pattern is used with HF or VHF transmitting gear or may support receiving antenna.

MAST HEIGHTS

Heights of masts are the best indication of the frequency and range of the radio installation. This is true because it is desirable to raise the antennae, and, thus, the feed wire which transmits, as far off the ground as possible for best operation. By relating the height to the number and type of mast, it is possible to estimate the station capacity by fairly logical means.

IN GENERAL

High Mast = low frequency = long wave = long range
Low Mast = high frequency = short wave = short range

The following table will be helpful in estimating frequencies and ranges from masts visible on aerial photographs.

JAPANESE RADIO COMMUNICATIONS, MAST-FREQUENCY RELATIONSHIP
FIXED INSTALLATIONS

	FREQUENCY	NO. MASTS	MAST HEIGHT	FREQUENCY IN MEGACYLES PER SEC.	WAVE LENGTH	*** USUAL OPERATING RANGE
STICK MASTS	*VERY HIGH (LINE OF SIGHT)	1	GERMAN DECIMETRE STATIONS HAVE 160' MASTS	30 TO 300 MCS (50 TO 100 LIKELY)	10 TO 1 METER	75 MILES
	HIGH	1 TO 3	WHIP ANTENNAE OR VERY SMALL STICK MASTS	3 TO 30 MCS	100 TO 10 METERS	****200 MILES
	MEDIUM**	2 OR MORE	50' TO 75'	0.3 TO 3 MCS	1000 TO 100 METERS	500 MILES
LATTICE MASTS	MEDIUM**	2 OR MORE	60' TO 100'	0.3 TO 3 MCS (300 TO 3000 KCS.)	1000 TO 100 METERS	500 MILES
	LOW	2 OR MORE	100' TO 500' (125' TO 300' MOST LIKELY)	0.03 TO 0.3 MCS (30 TO 300 KCS)	10,000 TO 1000 METERS	1000 MILES
	VERY LOW	3 OR MORE	400' TO 800' STICK OR LATTICE	10 TO 30 KCS	30,000 TO 10,000 METERS	5000 MILES

* Although there are many types of V.H.F. antennae in connection with portable, mobile, and airborne equipment, no fixed Japanese installations have been seen as yet which operate at such high frequency.
** Most used for land based communication stations.
*** Very rough figures, dependent on many factors.
****When utilizing sky waves, H.F. can transmit over long distances (beyond 1000 miles) on any height of mast.

Estimates of frequency in the following pages are based on the lowest frequency, and auxiliary higher frequency transmitters should be presumed to be present.

Rule of thumb method to determine wave length: Approximate wave length (in meters) 4 x mast height (in meters).

RANGE

1. Some factors which affect range are transmitter power, time of day, weather, time of year, sun spots, and receiver sensitivity.
2. A single steel lattice mast may sometimes be used as a radiating mast and its range would be less than normally expected of its height because of electrical difficulties in transmitting in this manner. In this case the station must operate on a limited fixed frequency and cannot be directional.
3. Many masts imply many channels of communication and do not necessarily mean added range.
4. Siting of masts on or near water gives added range.

SPACING

Spacing between masts in communications is not very important electrically, as is the case in Direction Finding and Navigational Beam installations.

However, due to the mechanical difficulties of supporting antennae in long spans, it can be assumed that the longer the span (or distance between masts) the more powerful the transmitter, for it would not be economically wise to build equipment in excess of the needs of the power of the transmitter.

By this reasoning, for example, a spacing of 500-600 feet would imply that a low frequency transmitter of considerable power were present.

[redacted]

COMMUNICATIONS

SUMMARY (CONT.)

BASES

Bases of lattice masts consist of three or four legs, set in square blocks of concrete which often show up clearly in aerial photos. (Occasionally the concrete bases of stick masts are visible)

It is quite possible to determine, very roughly, the height of the lattice mast by the distance between legs at the base. (this table for Japanese masts only).

Distance between legs.			Height of Mast.		
10	-	20	60'	to	75'
20	-	30	75'	to	125'
30	-	45	125'	to	200'
45	-	65	200'	to	300'

However, it is recommended that shadow or parallax measurements be used to determine height wherever possible.

PLATFORMS

Most Japanese lattice masts of recent design incorporate a relatively elaborate system of platforms near the top, triangular and rectangular in shape, ranging in size from 25 square feet to 125 square feet in floor area.

These platforms occur singly and in twos and threes. In a three mast station, identical platforms are found in each of the three masts.

NAMUR

PALAU

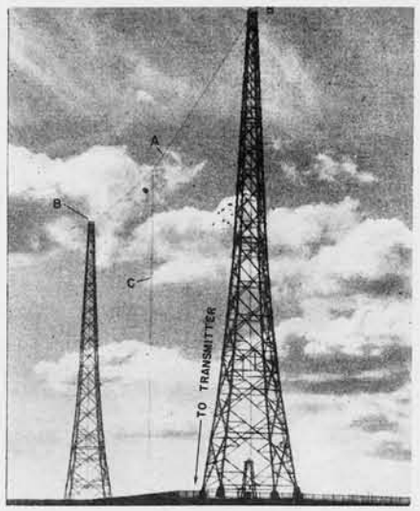
PROBABLE USES

a. Observation. In many cases no other observation towers are present.
b. Warning devices. Note siren in photo. (left above)
c. Light Beacons.
d. Visual Signals - The Japanese now possess, in addition to the usual blinker light signaling systems, equipment of German design which can send blinker or voice and may use infra-red light. The range is approximately eight miles and is not vulnerable to the usual jamming methods.
e. Antennae. It is possible but not determined by ground information, that certain platforms on low and medium frequency masts may contain high or very high frequency whip antennae or dipoles.

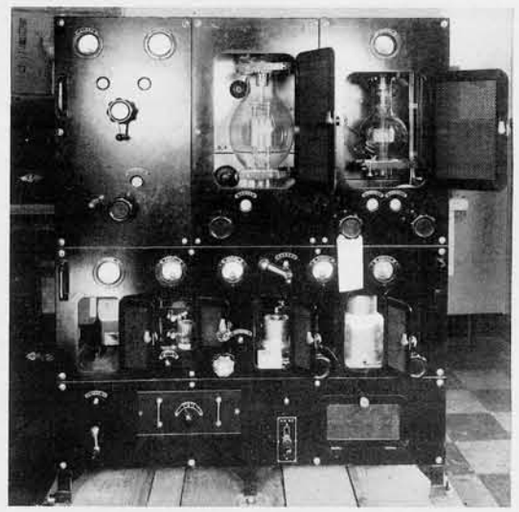
TRANSMITTERS

1. The transmitter is the most vital installation in a communications set-up and is usually found within 300 feet of the masts. It is possible that the communications office may be separated from the transmitter but the latter will be near the masts nevertheless. Generally they are grouped together, however. (See "Communications Centers").
2. Range increases as the square root of the increase in transmitter power. Example: 4 times the power = 2 times the range.

With this in mind, it can be readily seen that tremendous additional power must be used to establish reliable communications beyond the range for which the station was designed.



"A" - Antenna, "B" - Insulators, "C" - Feed



MEDIUM FREQUENCY TRANSMITTER

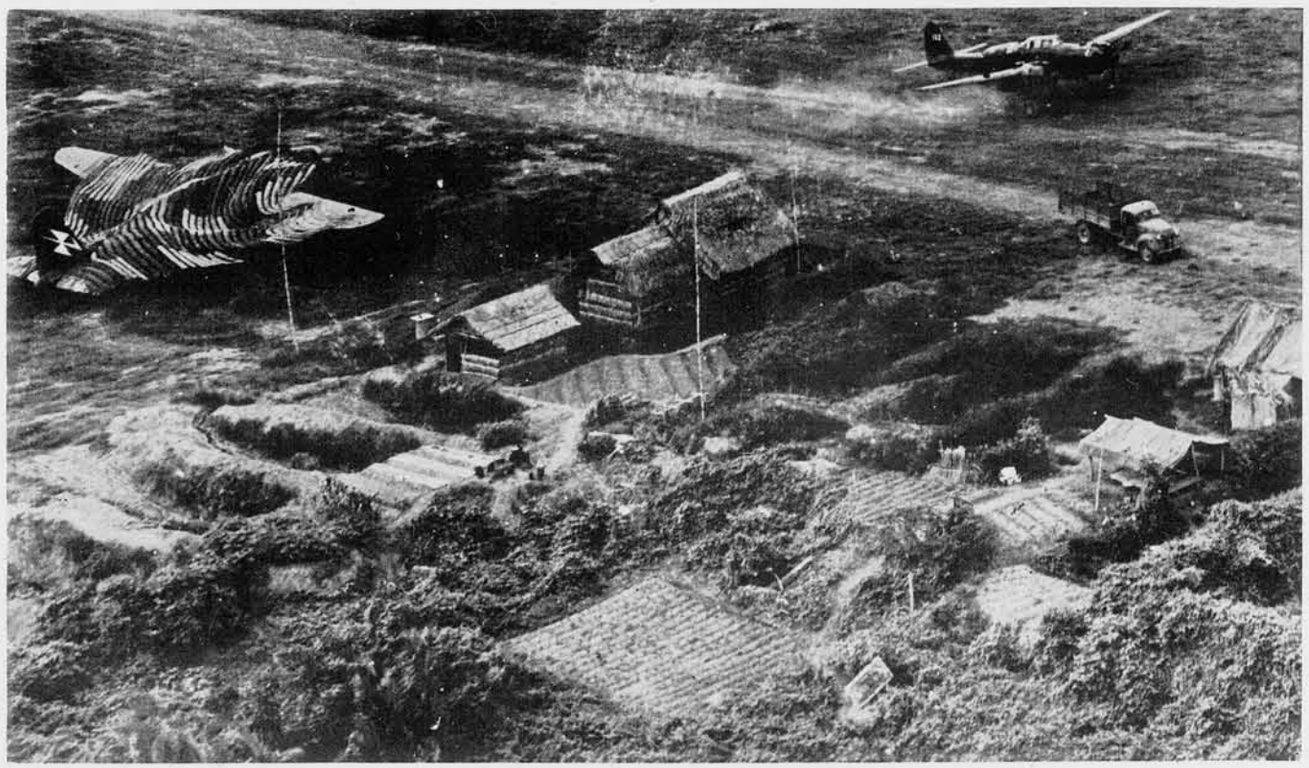
Receiving stations are often found some distance away from transmitting stations, and have their own masts and antennae.

PHOTOGRAPHIC INTERPRETATION REPORTS

In writing reports on Radio communication installations, it is desirable to mention the following:

1. Probable frequency of station.
2. Probable use of station.
   Example: (a) Communication Center
   (b) Weather Station etc.
3. Probable geographic area of range.
   (a) Important geographic connecting points (for medium frequency stations, particularly).
   (b) Other known stations within range.
   (c) Directional capabilities, if any.
4. Pattern of masts, especially if installation suggests a possible Direction Finder or Navigational Aid.
5. Location of transmitter and generator buildings.

COMMUNICATIONS
HIGH FREQUENCY



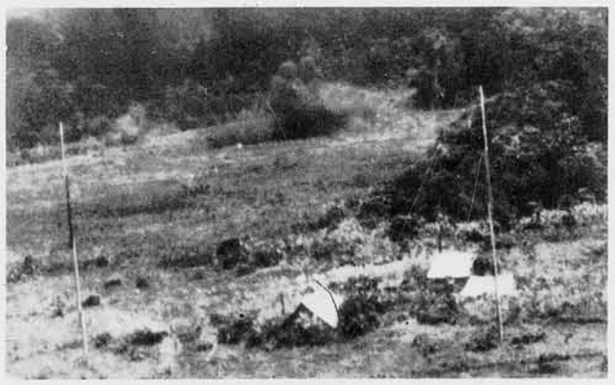
3 MAST- HIGH FREQUENCY

ABOVE: Ground to plane communication. Japanese High Frequency aircraft band is approximately 5 to 10 Mcs. High Frequency Radio Communication is not used by the Japanese for large land based stations except as a supplementary transmission. It is used as follows, (except for long range sky wave of approx. 10 mcs.)

(a) Near airports for communication with pilots in the air or on the runway
(b) Small well-hidden stations for short distance communications between commands
(c) Semi-portable, portable, mobile, and walky-talky sets for the ground troops, A/A batteries etc.

All of these types are extremely difficult to pick up on aerial photographs.

Mast arrangement may assume a variety of forms but is likely to be made up of small, flimsy wooden stick masts or whip antennae.



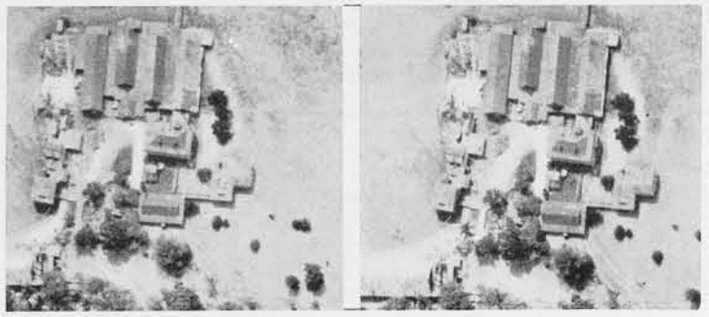
2 MAST- HIGH FREQUENCY

LEFT: Probable High Frequency Field Radio Station with transmitter and receiver housed in tents. This type of station may be interpreted with good photography at scales of 1/10000 or less.

Insufficient information is available on the use of Very High Frequency (V.H.F.) fixed installations by the Japanese. No transmitters of this frequency have been captured. V.H.F. can be used for portable transmitters, aircraft communications, and point to point communications over short distances (up to 75 miles). The German "Decimeter Stations" (which are 30 miles apart) are an example of the latter use.

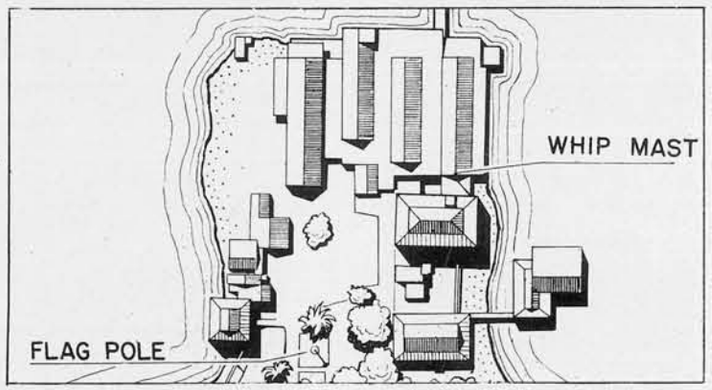
SINGLE MAST- HIGH FREQUENCY (R.F. - 1/7500)

ABOVE: Another example of ground to aircraft communication. This may be a type of stick mast or whip antennae carrying High Frequency messages for use of control tower at airport. Radio operates at 3-30 Mcs. This mast may be called a "whip antennae".



(R.F. - 1/2500)

WHIP ANTENNAE - HIGH FREQUENCY



ABOVE: Stereogram and sketch of whip antennae mounted on top of warehouse building. Such a station is often impossible to spot in aerial photographs, except when coverage is unusually low and photos are good. High Frequency transmitters are normally used for Communications over distances of less than 200 miles.

COMMUNICATIONS

MEDIUM FREQUENCY

Most Japanese communication stations fall in the Medium Frequency band (0.3 to 3 Mcs.). These stations take on many forms. The typical military communications center with a somewhat standardized concrete building and three 75 feet high lattice masts is already familiar to interpreters. Examples of these are shown under "Communication Centers".

In addition, a less standardized use of spliced stick masts with associated buildings of various designs and adaptations, is widely employed for medium frequency antennae in advanced areas.

Some stations, classified as "Medium Frequency" on these pages, probably overlap into the "Low Frequency" band. International standard breakdown and nomenclature is used for classifications throughout this report.

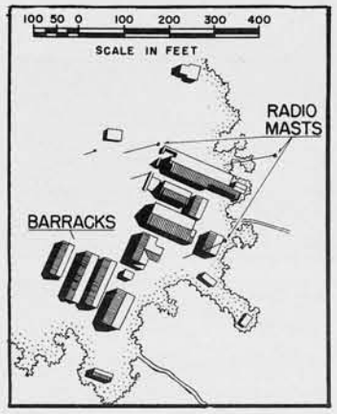
In the more built up land areas captured by the Japanese and on Japan itself will be found many peacetime broadcast stations operating in the medium frequency band as well as stations associated with airfields and industry. All of this latter group are likely to employ lattice masts.

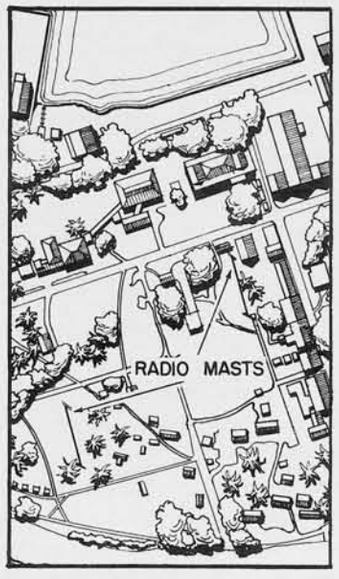
In this section, many examples of various types are shown and salient information and dimensions, as may be obtained from aerial photographs, are presented. Ground information is not yet available on most of the installations shown, so it is best not to regard any specific interpretation as the final word, but, rather, to utilize the benefits of a reference collection and an interpretation approach.

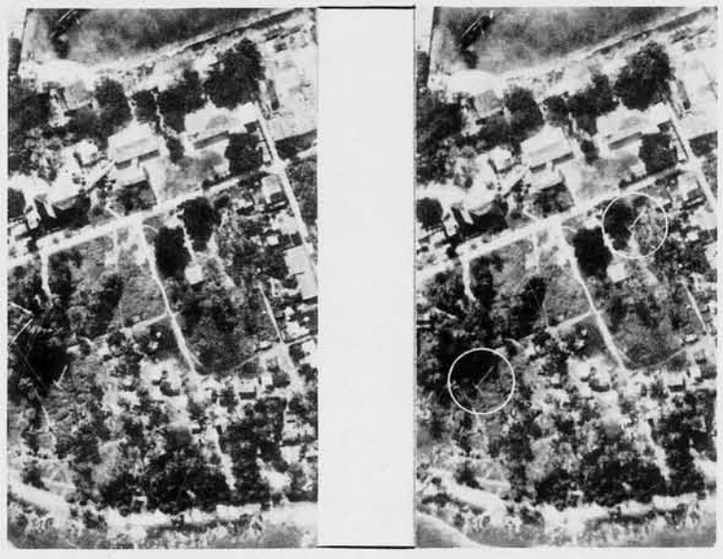
On this page are shown two Medium Frequency Communications Stations utilizing stick masts.

JALUIT: Masts over 100 feet high and 425 feet apart are excessive for Medium Frequency. However, it is unlikely that Low Frequency antennae would be carried on this type of stick mast. It is quite possible that this station will include the upper part of the Low Frequency band, as well as lower part of the Medium Frequency.

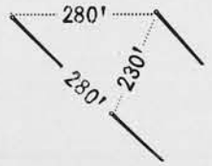
ARAIDO: Three Medium Frequency stick masts, 60 feet high, arranged in a near isoceles triangle pattern.

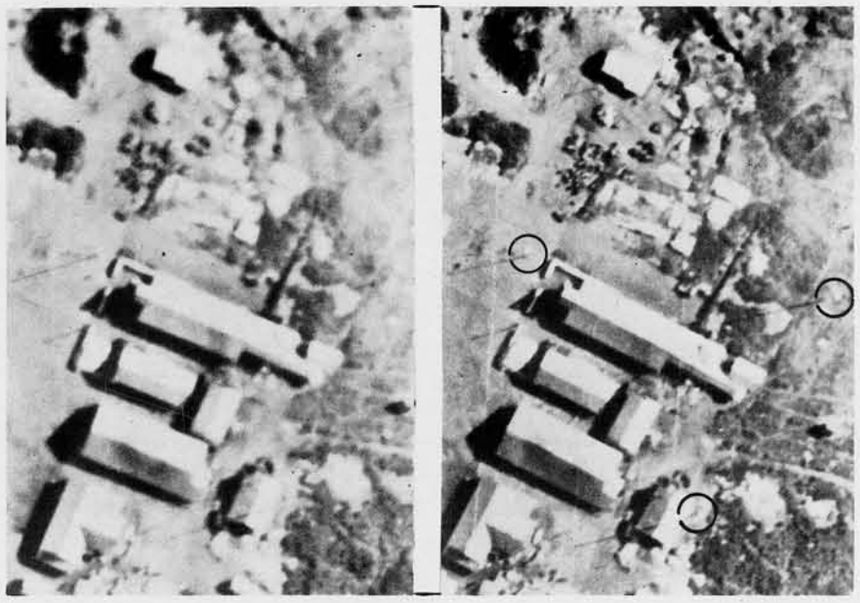




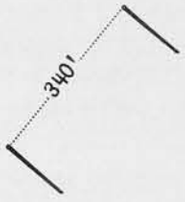


JALUIT, MARSHALLS (R.F. - 1/4250)

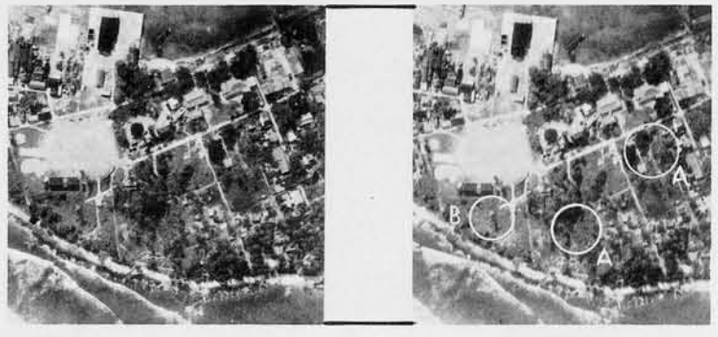




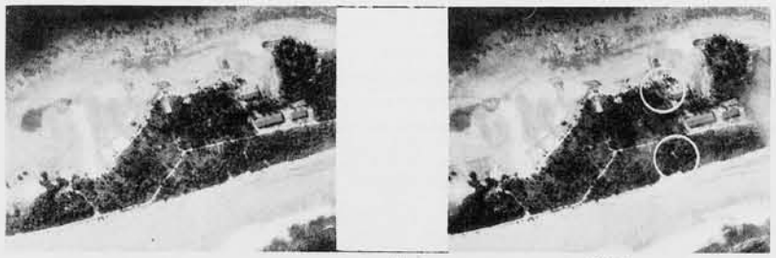
ARAIDO, KURILES (R.F. - 1/200)



RIGHT:
"A" - 100' stick masts.
"B" - observation tower.



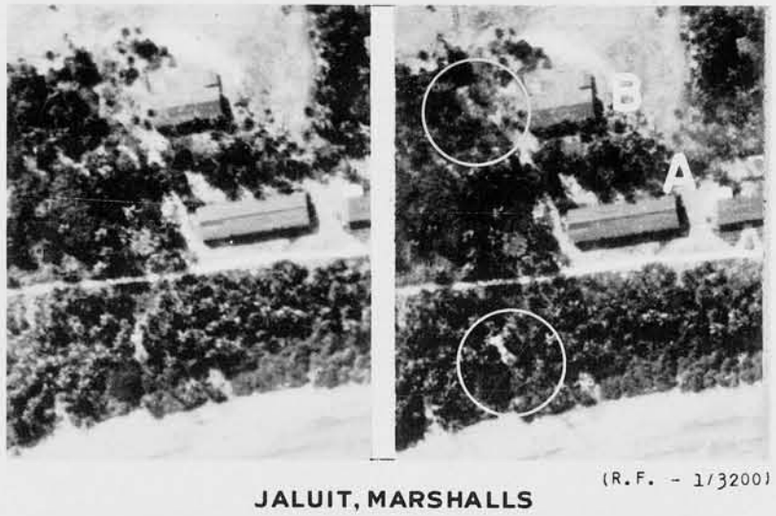
JALUIT, MARSHALLS (R.F. - 1/6750)



(R.F. - 1/12000)

JALUIT, MARSHALLS

Medium Frequency Station at Jaluit has two lattice towers, approximately 75 feet high, spaced 350 feet apart.

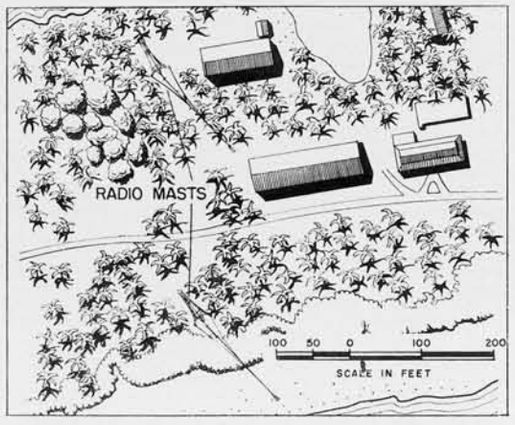


(R.F. - 1/3200)

JALUIT, MARSHALLS

Three masts, of steel lattice design with platform, are L-6 type.

The transmitter is probably at "A"; the power is probably at "B".



350'

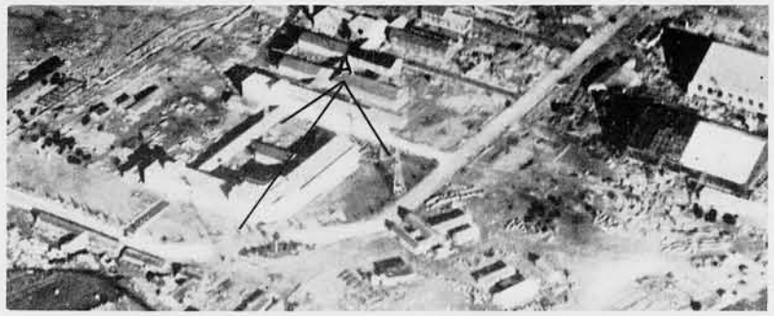
JALUIT, MARSHALLS

210'

(R.F. - 1/4000)

PALAU

Steel lattice masts at Palau, approximately 75 feet high, are for Medium Frequency Communications. Water siting offers better ground. Type L-6.



375' ±

HOKKAIDO, JAPAN (BIHORO)

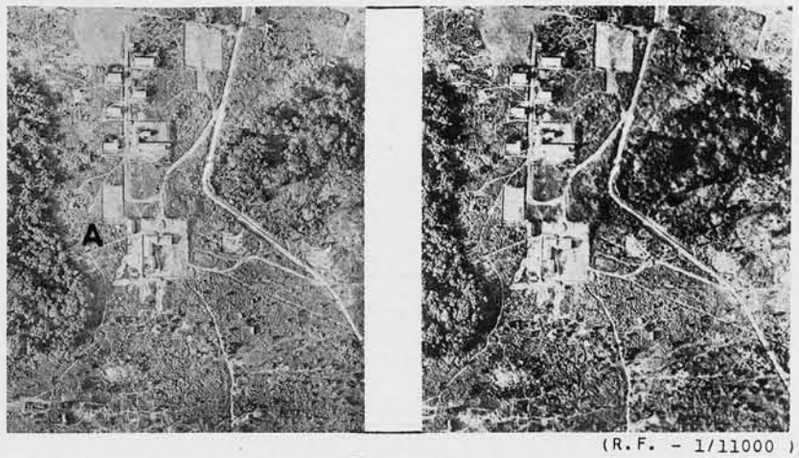
300'

HOKKAIDO, JAPAN (CHITOSE)

The two examples above (Bihoro and Chitose) show Medium Frequency lattice masts in connection with Japanese industrial plants and airfields. Masts are type L-6.

Lattice masts (A) are 100 feet or less in height, which indicates probable Medium Frequency - but fairly powerful stations.

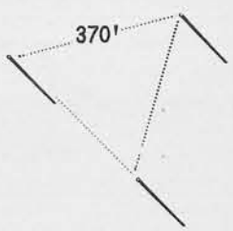
COMMUNICATIONS
MEDIUM FREQUENCY (CONT.)

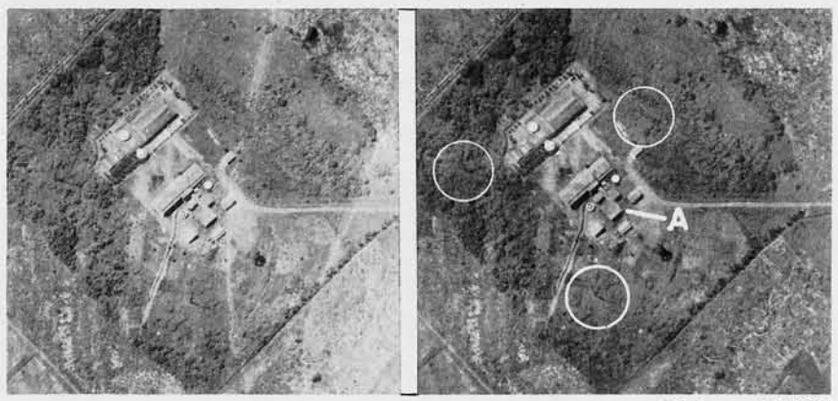


(R.F. - 1/11000)

PALAU

Probable Medium Frequency lattice masts, type L-6. This arrangement is unusual in that the towers do not appear to be related to a transmitter building for convenient direct feed wire connection. Note power or telephone line at "A". This is a border-line example and could be Low Frequency or a powerful Medium Frequency Station.

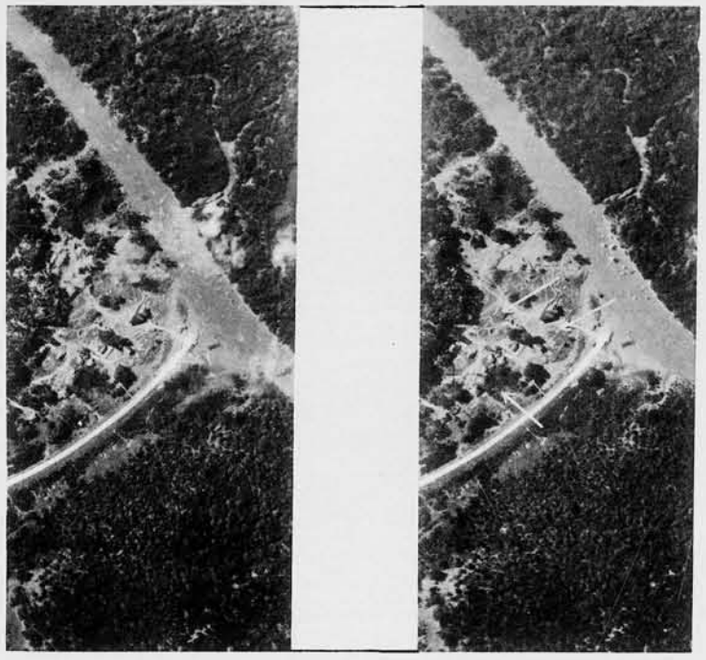




(R.F. - 1/4500)

PONAPE, CAROLINES

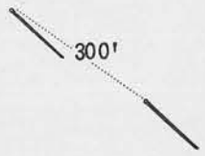
Medium Frequency station with three type S-5 stick masts. Transmitting building is at center of three masts. Power is at "A" (Note proximity of water cooling building). Building at top is a barracks. A station of this size frequently has lattice masts.

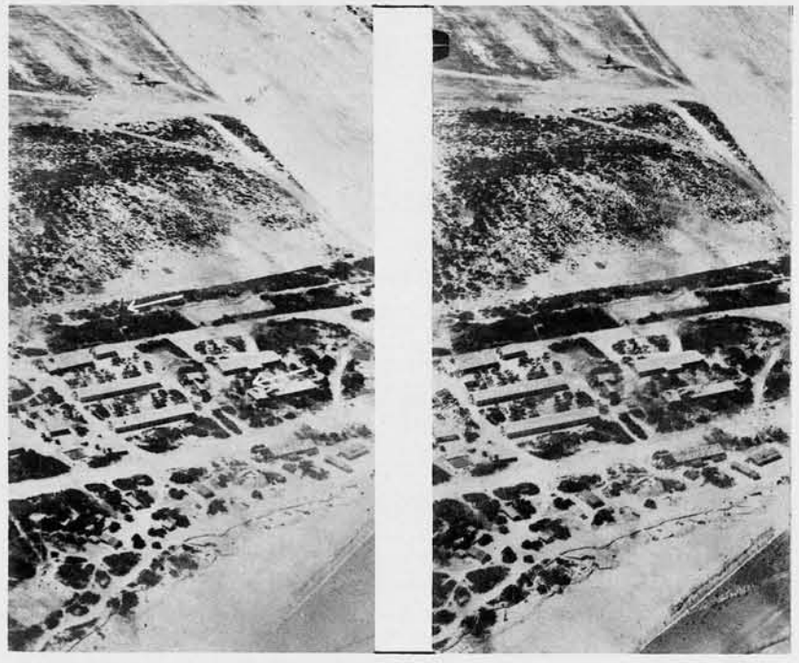


(R.F. - 1/5500)

BURMA

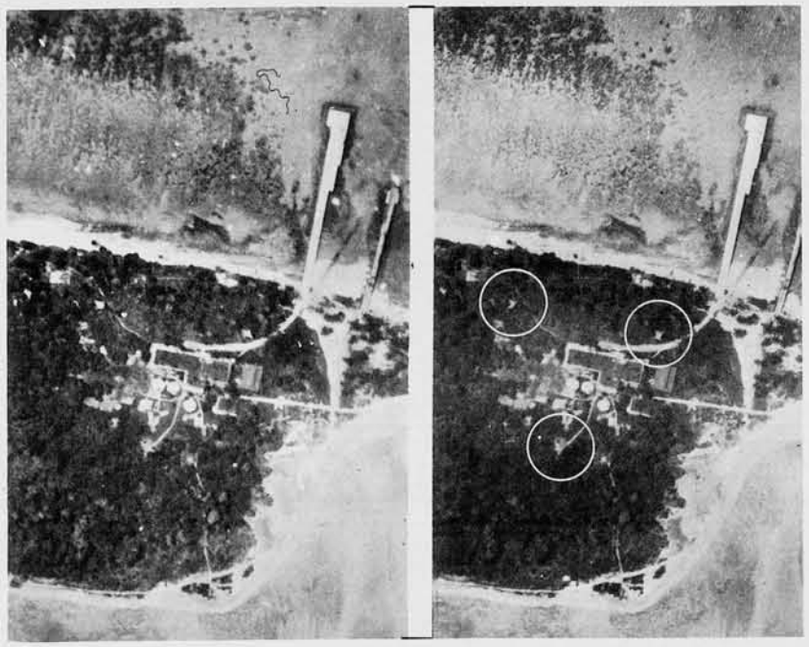
Existing trees might be used effectively to camouflage a radio installation. In this example palms appear to be used as masts for support of Medium Frequency antennae.





WAKE

Stereo-oblique of Medium Frequency station with 60' type S-1 stick masts. Transmitter appears to be buried.



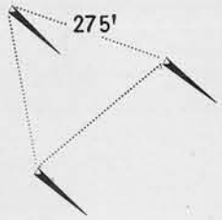
(R.F. - 1/4300)

PIGEEYATTO, MALOELAP, MARSHALLS

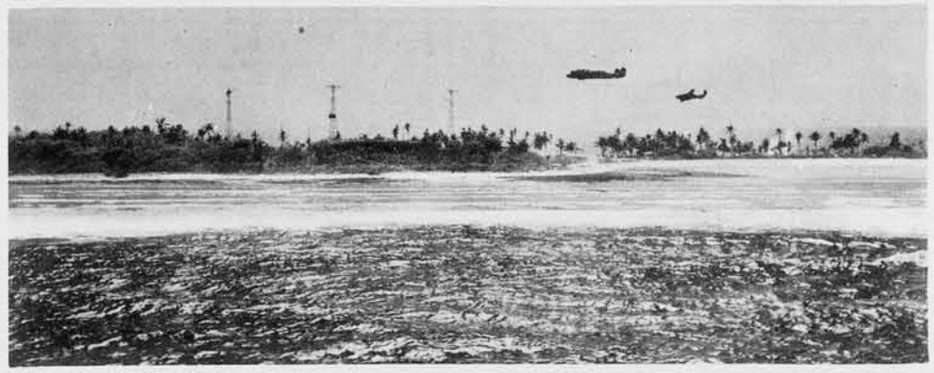
ABOVE: The station on Maloelap is introduced here as a typical example of the standard Medium Frequency communications building and arrangements of mast as shown in "Communications Center" section. This design is a favorite of the Japanese throughout their island bases. The lattice masts are usually 75 feet high arranged in an equilateral triangular pattern with 150 to 300 feet sides.

"A" - Two of the three 75' high lattice masts.

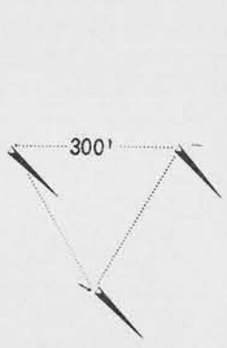
"B" - Platform and signal light.

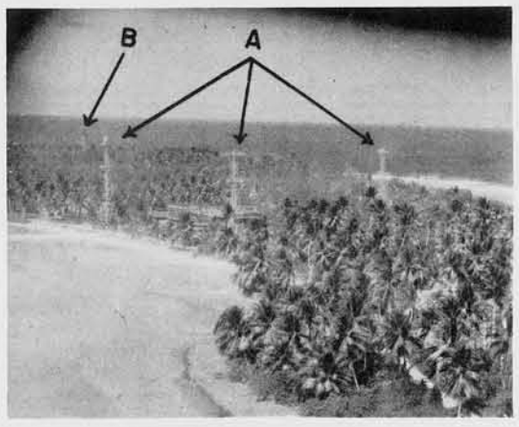


PIGEEYATTO, MALOELAP, MARSHALLS



PIGEEYATTO, MALOELAP, MARSHALLS





JALUIT, MARSHALLS

Medium Frequency communications center at Jaluit, which is similar to Maloelap.
"A"-THREE LATTICE MASTS - 75 FEET HIGH; "B"-OBSERVATION TOWER.

PIGEEYATTO, MALOELAP, MARSHALLS

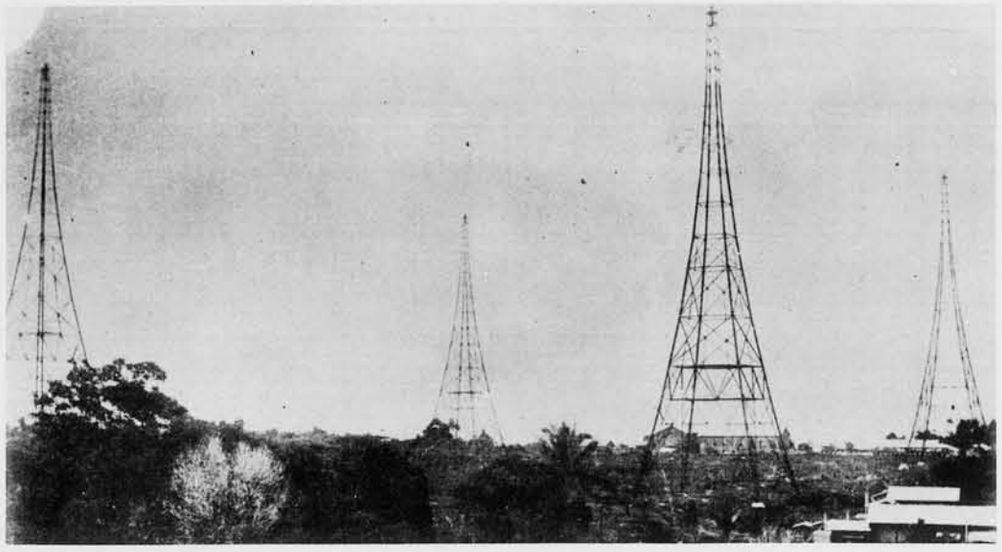
PIGEEYATTO, MALOELAP, MARSHALLS

COMMUNICATIONS
LOW FREQUENCY

The stations shown here under "Low Frequency" include "Very Low Frequency" and some that may be unusually powerful "Medium Frequency" stations, which would have added range.

Irrespective of exact determination of frequency, which is often very difficult, it is important to refer to installations such as shown on these particular pages as powerful, long range stations in the lower frequency band.

The most powerful Communications Stations are likely to be Low Frequency and are more often found in the Inner Empire, and in other well-populated conquered areas.

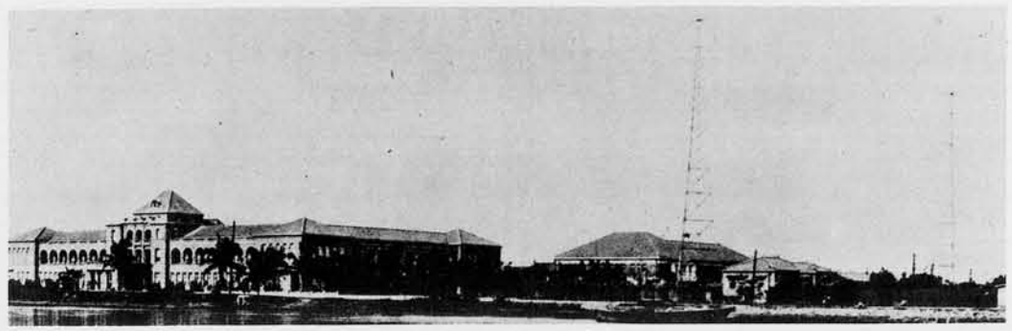


KOROR, PALAU

View of Koror Radio Station taken in 1926. At this time the station operated on several frequencies, including low, and could communicate with Japan. The masts are 300 feet high and arranged in a square pattern, 800 feet on a side.

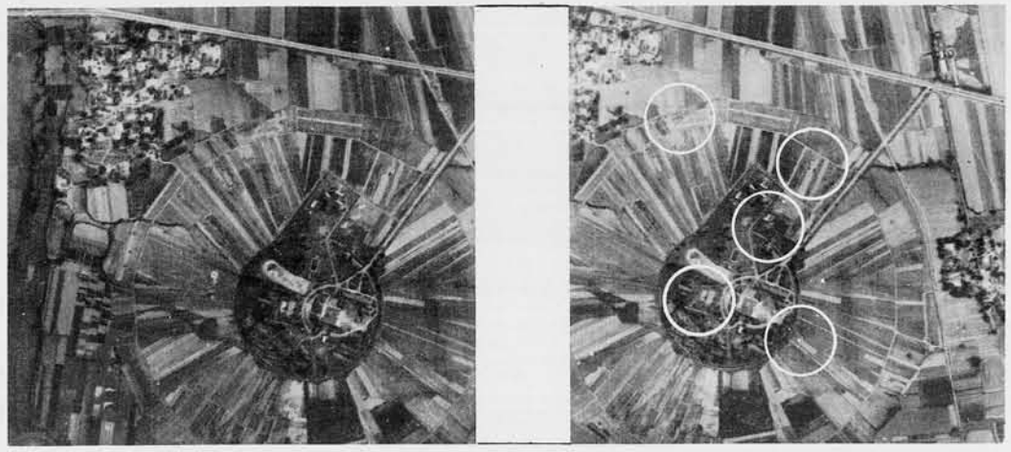
KOROR, PALAU

Same station at Koror taken July 1944. This installation is also included under Navigational Aids because its pattern and dimensions indicate such a capacity in addition to communications.



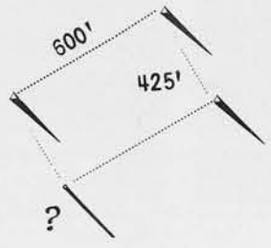
TAKAO, FORMOSA

Low Frequency lattice masts adjacent to Provincial Office Bldg., Takao, Formosa.



TAKAO, FORMOSA (R.F. - 1/16400)

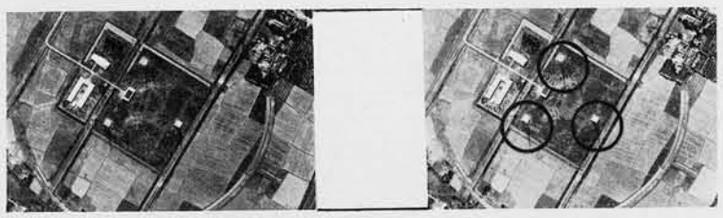
The Hozan Station at Takao is one of the largest and most powerful in Japanese possession. The five lattice masts are 350 feet or more in height. The cross-shaped building appears to be a recently constructed transmitting and administration center. The heavily revetted building probably houses the main transmitter, which may include Low Frequency. Masts are spaced 800'-1000' The circular and radial patterns seem to be a result of tuning houses which are set up on the outside diameter. These houses are 15 feet square and are arranged in groups of threes (in equilateral triangles); they number 54 in all.



TAKAO, FORMOSA (R.F. - 1/16400)

Another probable Low Frequency Station at Takao. Two lattice masts are 125 feet high; two are 90 feet high. Transmitter is in large central building.

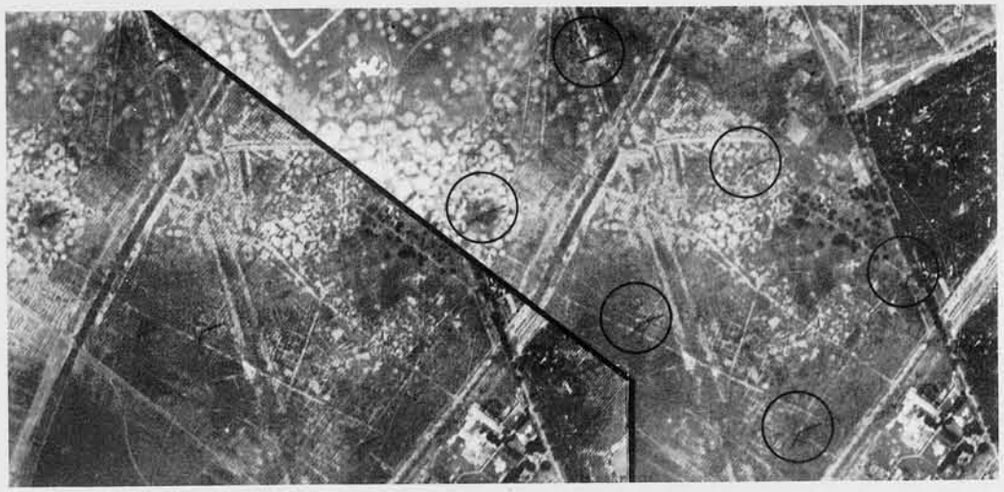
Takao has several high powered Radio Communication Stations.



BANKOK, THAILAND (R.F. - 1/17700)

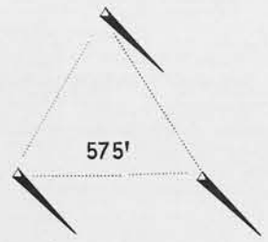
Low Frequency station at Bankok with 225 foot high lattice masts. Transmitter building has dark tone on roof.

BABELTHUAP, PALAU (R.F. - 1/7500)

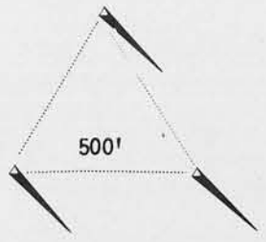


SAIGON, F.I.C. (R.F. - 1/13500)

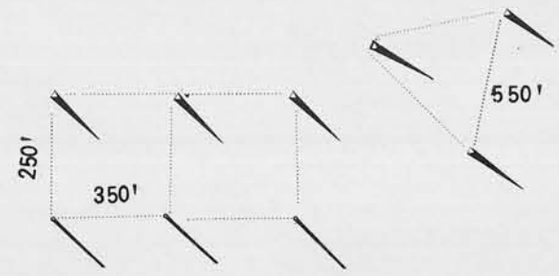
Powerful Low Frequency or Very Low Frequency station under construction at Saigon, French Indo China. This arrangement of high stick masts apparently erected for supporting triatrics, is a typically French design. (Note Bourges Station under "German").



BANKOK

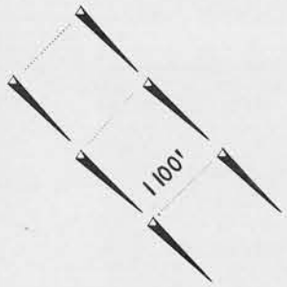


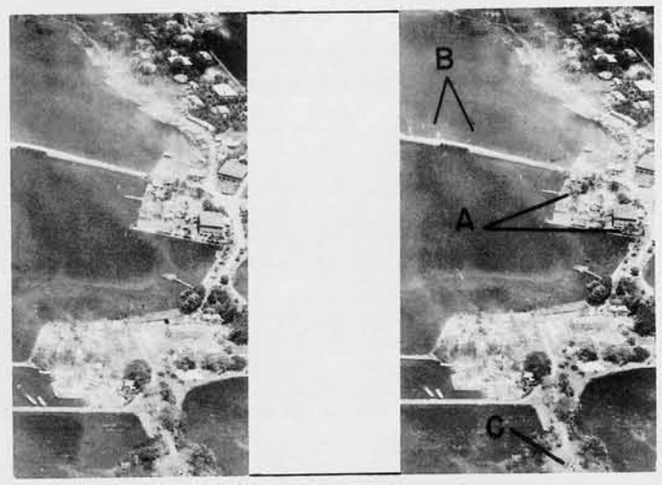
YAP



PALAU

LEFT: Six lattice masts and three stick masts support Low Frequency antennae at this large station on Palau. (See page 2.17) The numerous small stick masts that are present do not show up in this vertical. Cross-shaped building is probably housing for one or more transmitters. All masts shown are between 150 feet and 225 feet in height.





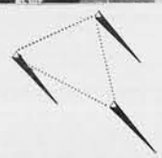
YAP

YAP

"A" - 125 FEET HIGH - LATTICE MASTS.
"B" - TRANSMISSION LINES.
"C" - 60 FEET HIGH SPLICED WOOD STICK MAST.

This station at Yap is probably Low Frequency. The masts are in a triangular pattern with the large, three-storied building in the center (probably housing for transmitter).

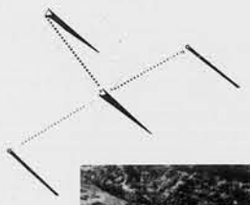
COMMUNICATIONS
LOW FREQUENCY (CONT.)



TOKYO, JAPAN

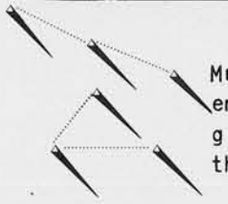
Three lattice masts of a pre-war Low Frequency Station in Tokyo. These masts are about 250 feet high and arranged in an equilateral triangle with 500 to 600 foot sides.

PARAMUSHIRO (R.F. - 1/9000)

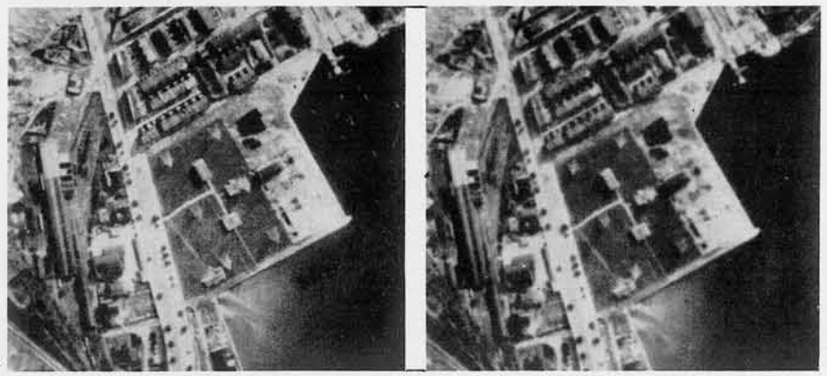


Night photo of station at Surabachi Wan, on the east coast of Paramushiro. The masts, two lattice and two stick, are arranged in a "T" form with the bottom of the "T" pointing toward Tokyo. This station may be directional.

CHICHI JIMA, BONIN IS.



Multi-mast Low Frequency Station at northern end of Chichi Jima. Note effect of hilly topography on design of lattice masts. Note also the seaplane base.



(R.F. - 1/1000)

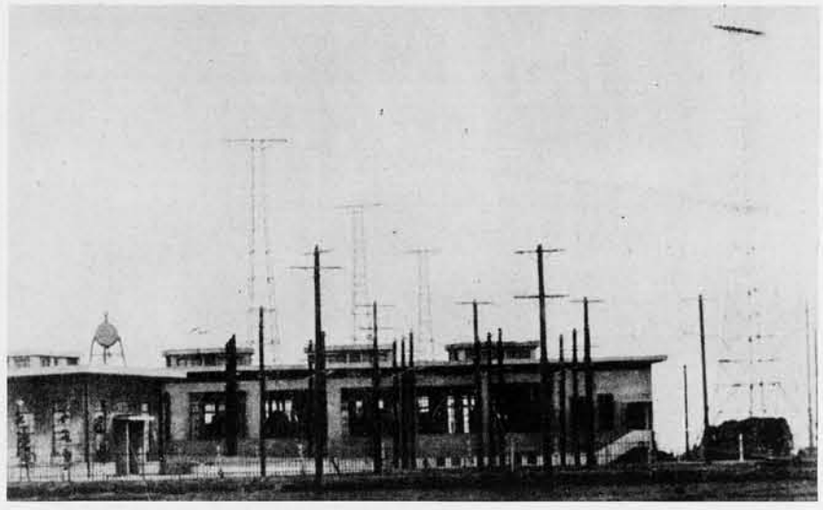
KOWLOON, CHINA

Pre-war British broadcast station at Kowloon, near Hong Kong, now being operated by the Japanese.

(R.F. - 1/15200)

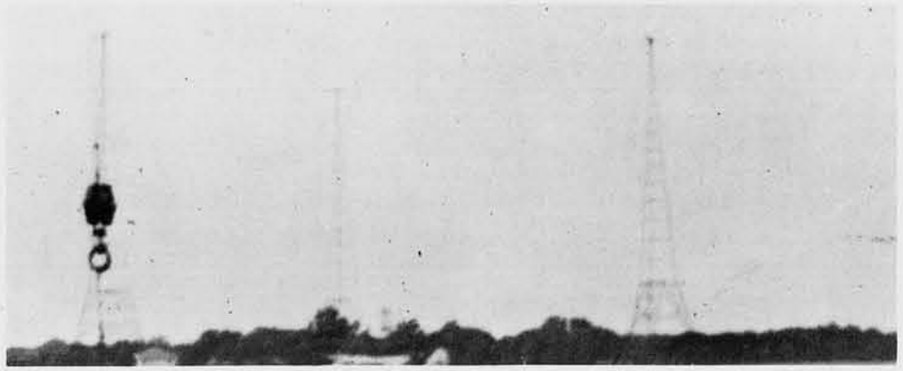
PESCADORES IS.

Medium or Low Frequency Station. Two lattice masts, 100 feet or more in height, are supporting the antennae. This installation appears to be of fairly recent construction.



YOSAMI, HONSHU, JAPAN

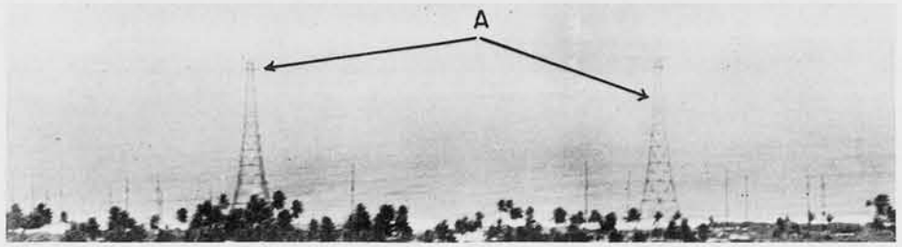
The Yosami station is a Japanese pre-war communications center and broadcasting station.



CAVITE, PHILIPPINES

Above and to the right are views of a Very Low Frequency military station, constructed by the U. S. at Cavite. Although there are now but two masts left of the original three, the Japs appear to have reconstructed and are now using this station.

The masts are 600 feet high, which is taller than any masts of Japanese design yet discovered outside of Japan proper.



KWAJALEIN

Two lattice masts, 210 feet high, used by the Japanese at Kwajalein. One was damaged during U. S. occupation of the island. The two lattice masts were spaced 500 feet apart.

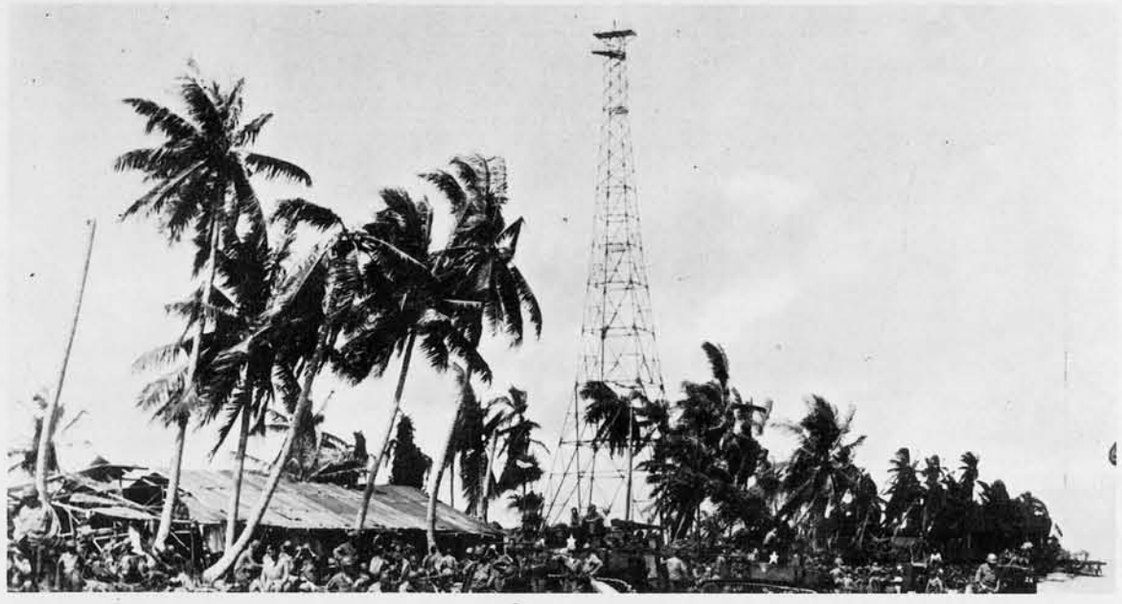
KWAJALEIN

"A" - 210' LATTICE MAST

"B" - SITE OF 210' LATTICE MAST DAMAGED DURING OCCUPATION BY U. S. FORCES.

CAVITE, PHILIPPINES

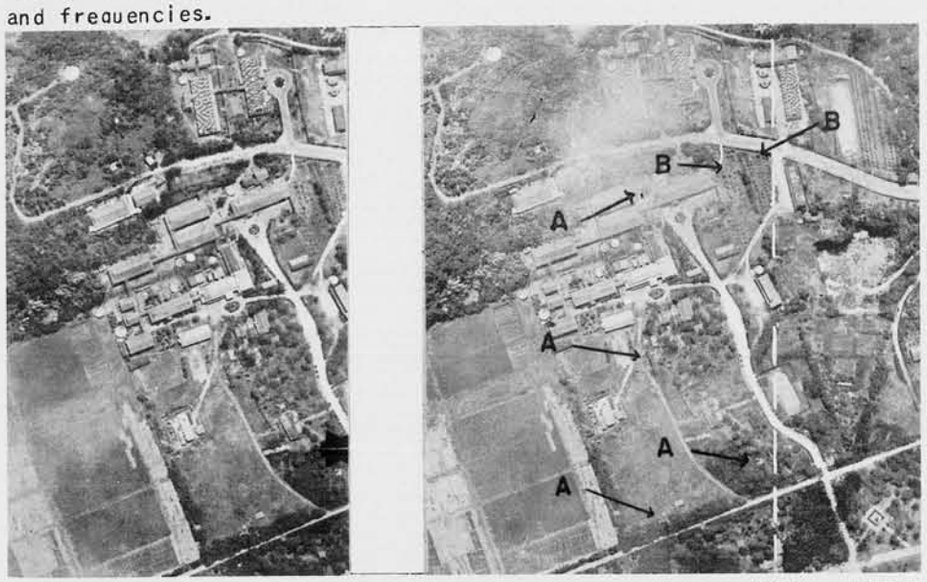
KWAJALEIN



KWAJALEIN

COMMUNICATIONS
COMBINATIONS

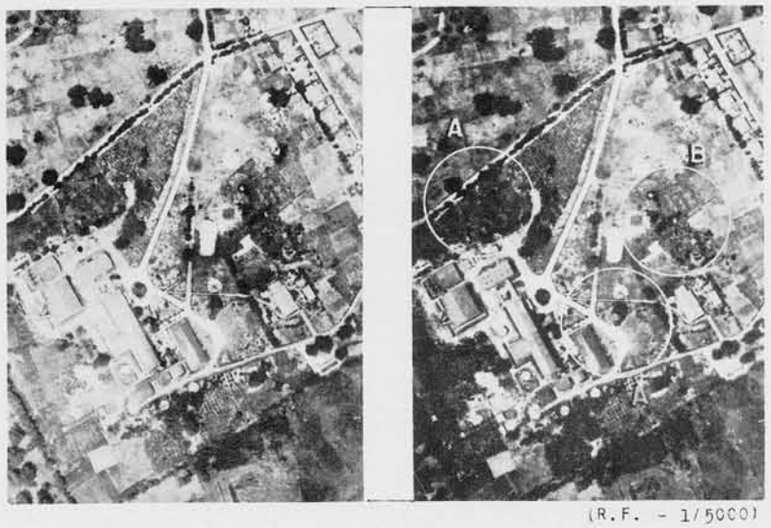
The following two pages of "combinations" are included to make comparisons between the appearance of masts of different types, heights and frequencies.



(R.F. - 1/5000

SAIPAN, MARIANAS

"A" - FOUR 100 LATTICE MASTS. "B" - TWO 50 STICK MASTS.

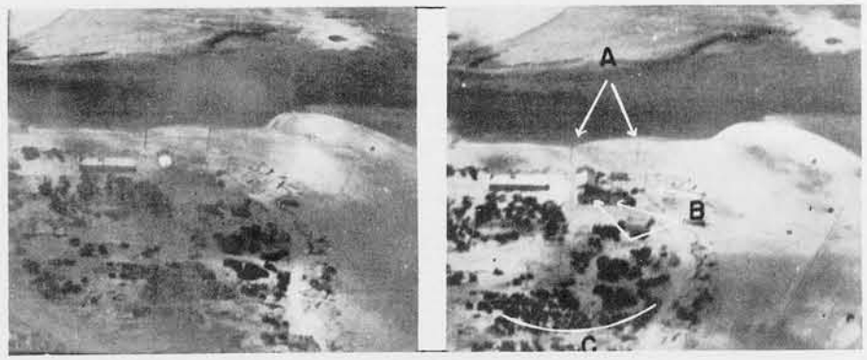


(R.F. - 1/5000)

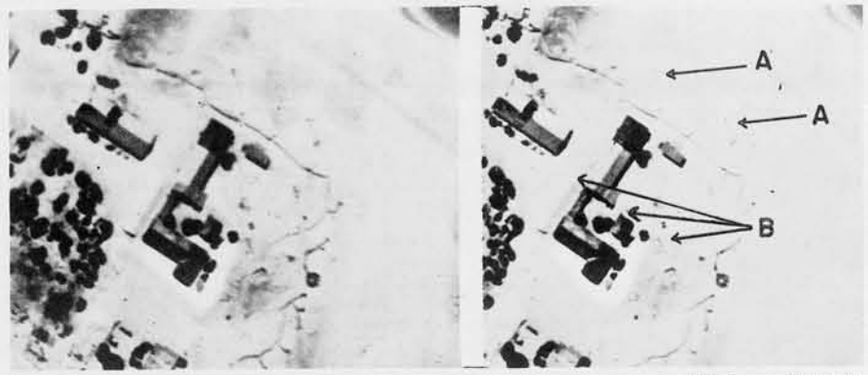
SAIPAN, MARIANAS

"A" - TWO 125' LATTICE MASTS. "B" - THREE 60' STICK MASTS

When topography is very rough, or when the sun is high at the time of photography, it is difficult to estimate the height of masts.
The two stations above at Saipan probably include Low, Medium, and High Frequency transmitters.
In the lower picture, the three closely spaced stick masts in line are unusual. No report has been received on this from the field, however.



WAKE



(R.F. - 1/2200)

WAKE

"A" - TWO 60' STICK MASTS
"B" - THREE 35' STICK MASTS
"C" - RECEIVING ANTENNAE AND/OR POWER LINES

The above views, when compared, show the value of obliques for picking up detail sometimes missed in vertical coverage. This is a poor example of the capabilities of this method.
Low altitude stereo-obliques, simultaneously exposed, would have great value in electronics interpretation.

(R.F - 1/14800

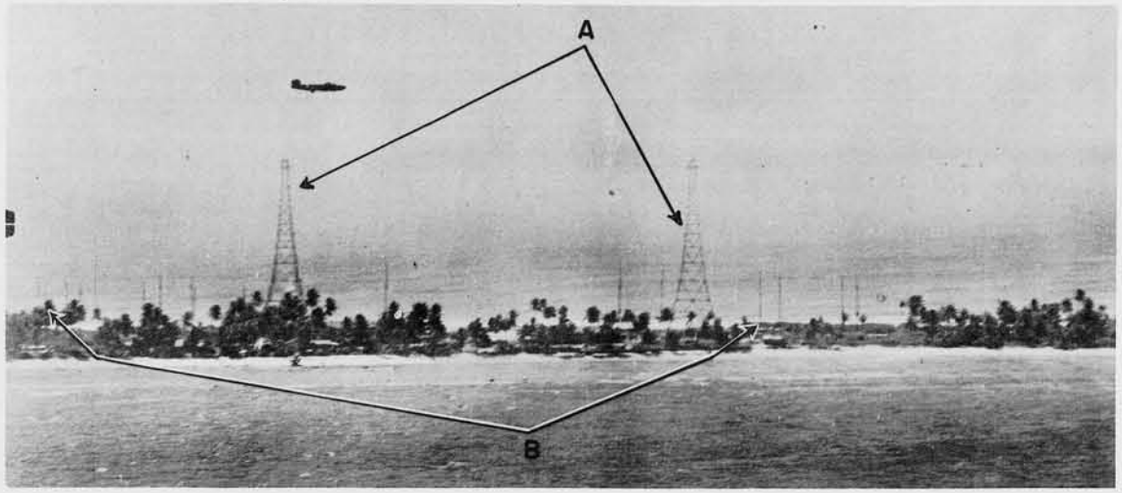
TAIHOKU, FORMOSA

"A" - THREE 200' LATTICE MASTS.

"B" - TWO 75'-100' STEEL STICK MASTS.

"C" - TRANSMITTER PROBABLY IN THIS BUILDING.

COMMUNICATIONS
COMBINATIONS (CONT.)



KWAJALEIN

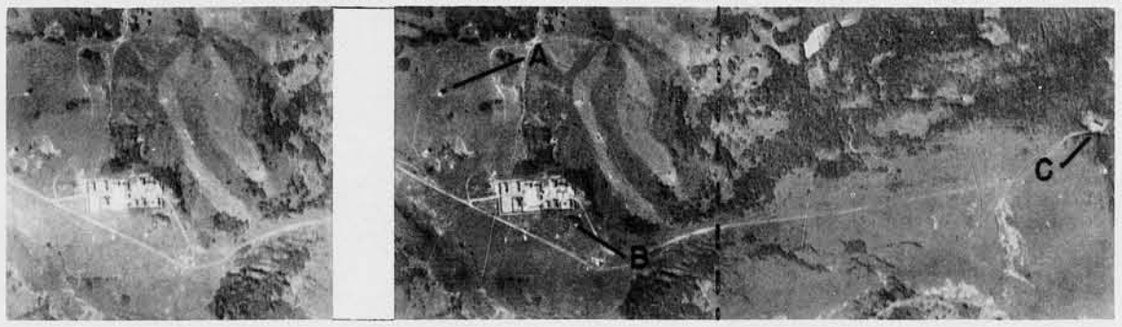
"A" - TWO 210' LATTICE MASTS. "B" - SIXTEEN 60'-75' SPLICED WOOD STICK MASTS.

This station is now in Allied possession. One lattice mast was damaged during occupation.

(R.F. - 1/7500)

OKINAWA

Combined Low Frequency radio communications and weather station at Naha, Okinawa.

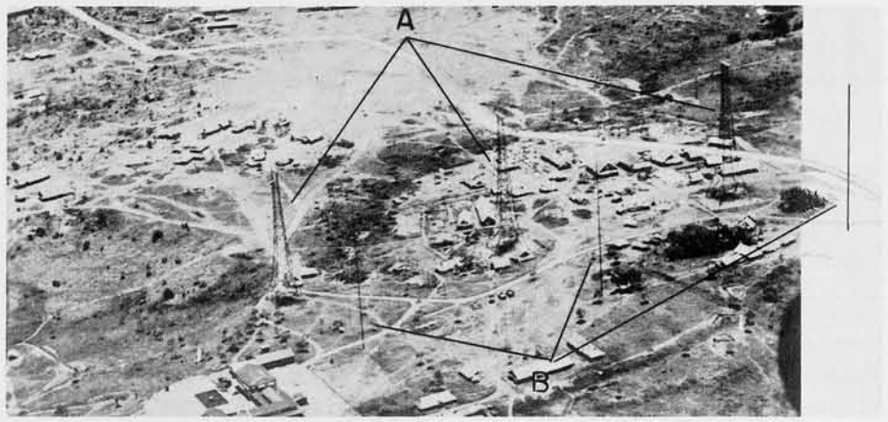


(R.F. - 1/2000)

GARANBI POINT, FORMOSA

"A" - HIGH FREQUENCY D.F. TOWER. "B" and "C" - MEDIUM FREQUENCY COMMUNICATION STATION

Two Medium Frequency Communications Stations in Formosa, spaced 1200 yards apart. One serves as a reporting station for a D.F. aid to navigation.

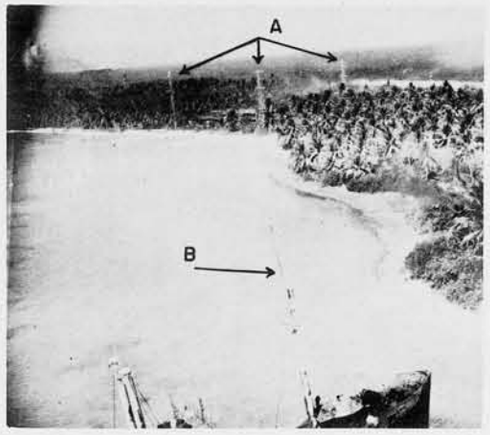


BABELTHUAP, PALAU

"A" - THREE 200' LATTICE MASTS "B" - THREE 150' STEEL STICK MASTS

This is a section of a very large multi-channel Communications Center shown elsewhere in this section. This pattern appears to be directional.

BABELTHUAP, PALAU



JALUIT, MARSHALLS

"A" - THREE 75' LATTICE MASTS "B" - SHIP'S COMMUNICATION ANTENNAE

In the background, can be seen a typical Japanese Military Communications Center with standard concrete building.

COMMUNICATIONS

COMMUNICATION CENTERS

The Japanese have standardized a type of Medium Frequency Communication Center design to such an extent that it is easily recognized, even with very small scale photography. This particular design has been found in about fifteen different localities to date.

The arrangement consists of three 60'-75' Lattice Masts laid out in an equilateral triangular pattern with the communications building in the center of the pattern.

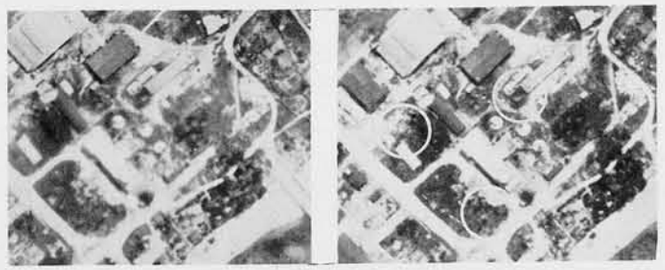
The Communications Building is of modern looking concrete design with flat roof slabs and parapets. It is usually two stories in height and embodies an asymmetrical disposition of roof terraces.

This building houses the transmitter, generators, and storage batteries. In addition are communication offices, living quarters and storage.

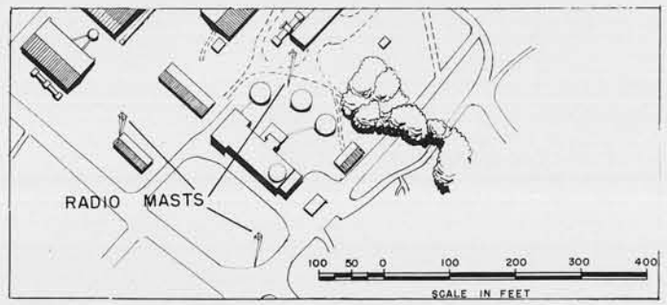
Throughout the Pacific Islands, 20' diameter cisterns (usually three in number) are clustered near the building. Other smaller auxiliary buildings include water cooling tanks (probably for the water-cooled Diesel engines used for generating power), and a concrete oil storage building.

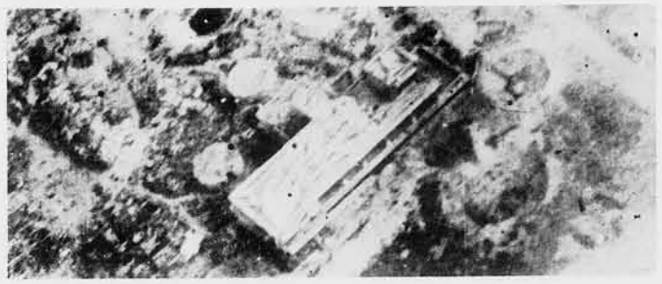
Other types of Communication Centers are also taken up in this section.

All pictures on this page are of a station at Taroa, Maloelap, Marshalls, showing most of the features mentioned. The masts here are spaced 175 feet apart and support the now familiar platforms. These masts are slightly different from the majority used with this type of station in that they are but 60 feet high. The platforms are triangular in shape.

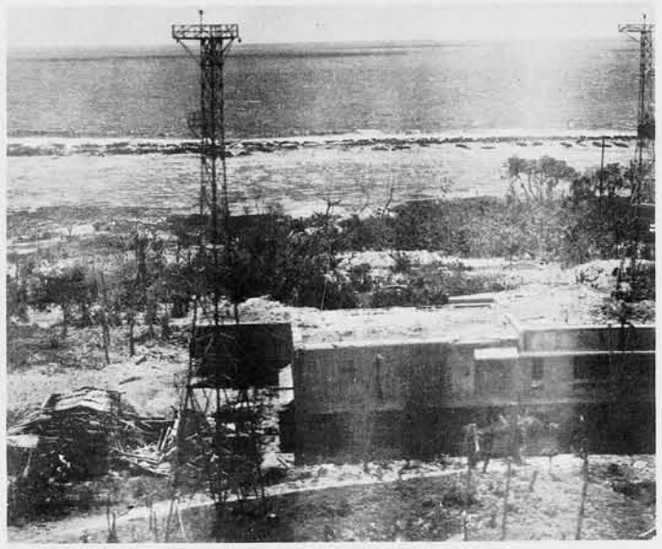


TAROA, MALOELAP (R.F. - 1/5500)





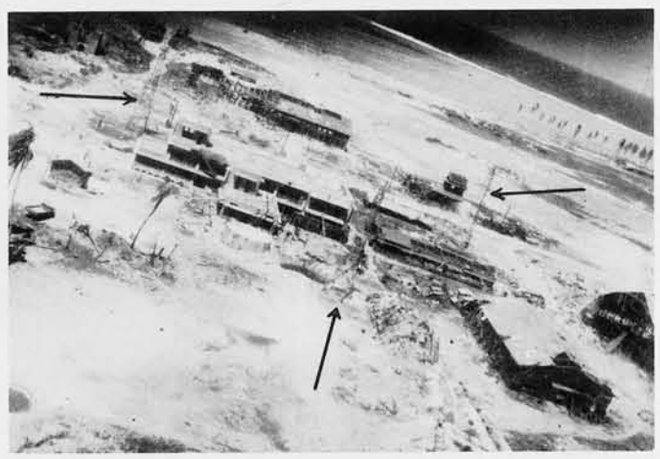
MALOELAP



MALOELAP

MALOELAP

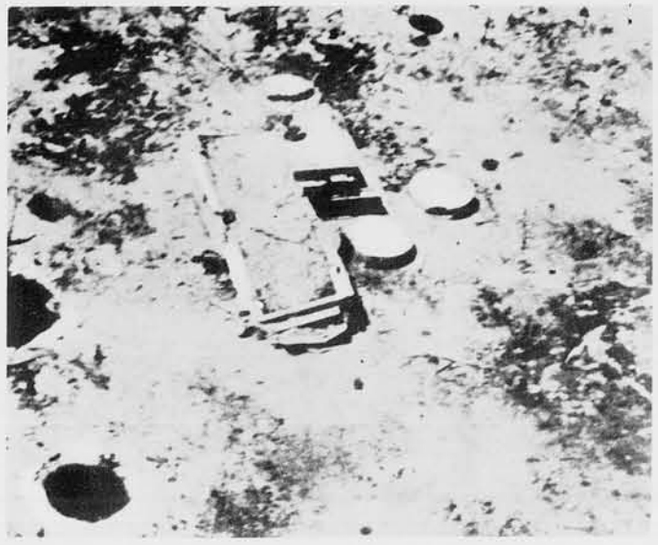
MALOELAP



MALOELAP

MALOELAP

NORTH RADIO STATION, WOTJE

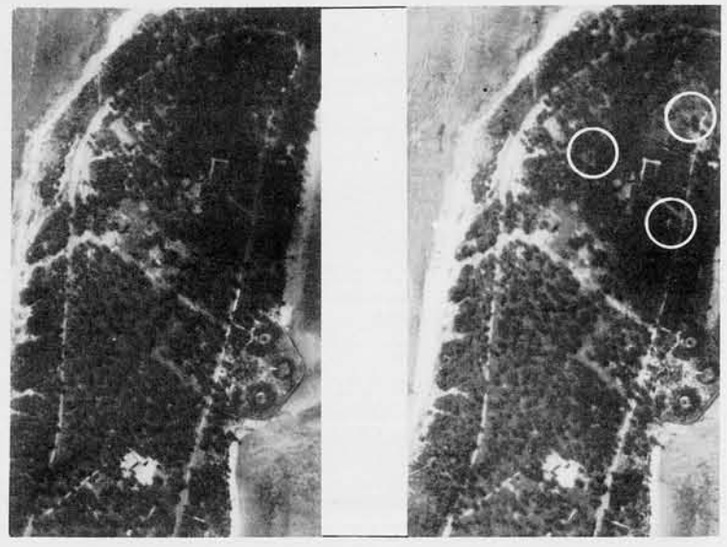


SOUTH RADIO STATION, WOTJE

These stations include the main building, (housing the transmitter, generator, offices etc.), oil storage, water cisterns and cooling tanks.

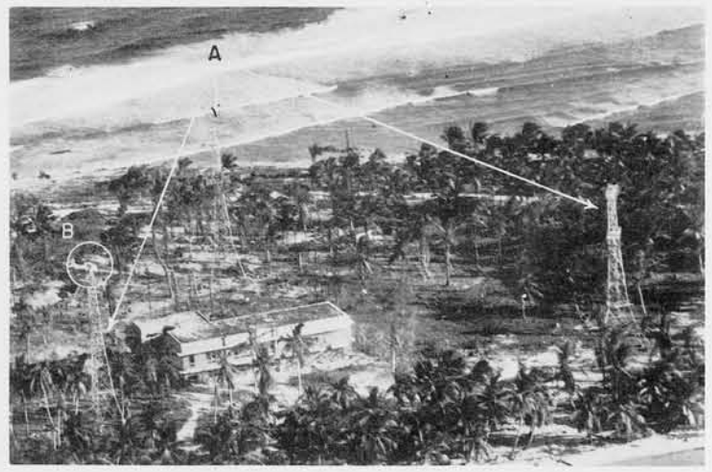
Although the concrete main buildings vary somewhat in design details, they are sufficiently alike in general form to encourage use of the words "standard type".

The cisterns are not likely to be present when this building is used in areas of adequate fresh water resources. In certain photos, the pipes leading from the roof, where water is collected, to the cisterns, are clearly visible.



(R.F. - 1/10000)

WOTJE, GILBERTS

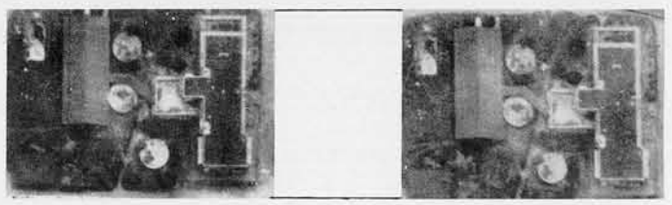


WOTJE, GILBERTS

Oblique showing three 75 foot lattice masts with platforms and concrete building of typical design.

"A" - THREE LATTICE MASTS TYPE L-5

"B" - VISUAL SIGNALLING LIGHT



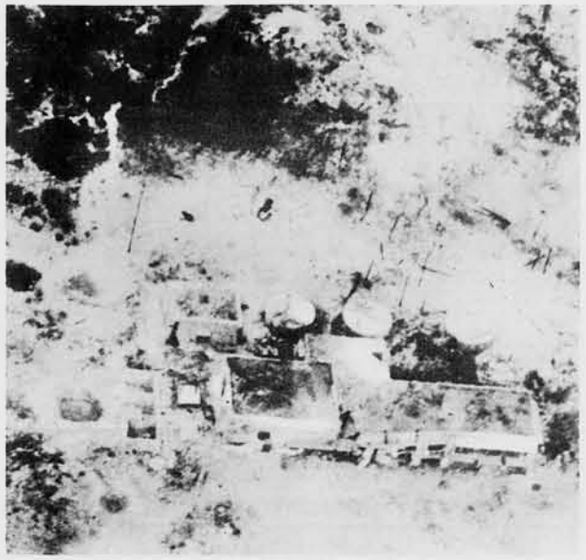
TINIAN (R.F. - 1/2500)

Detail of Center at Tinian reveals building very similar to that at Taroa, Maloelap.

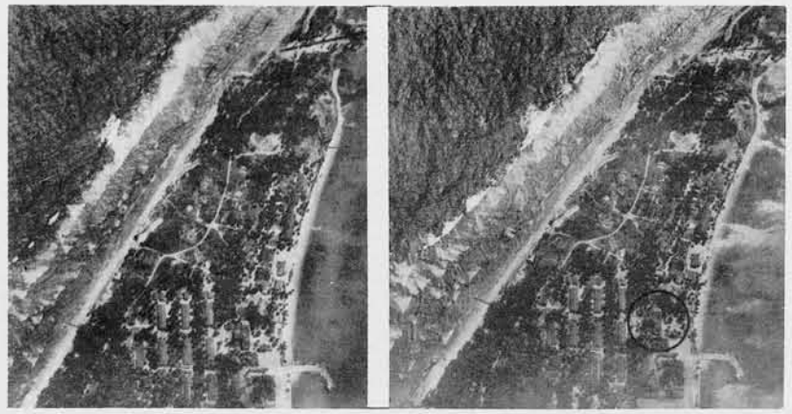
SOUTH RADIO STATION, WOTJE

WOTJE, GILBERTS

COMMUNICATIONS
COMMUNICATION CENTERS (CONT.)



JALUIT, MARSHALLS

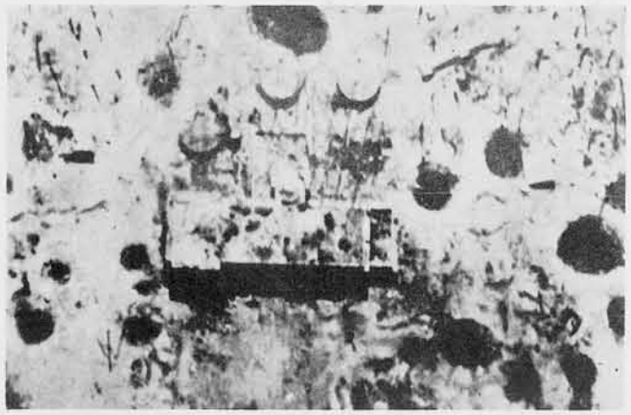


(R.F. - 1/11000)

JALUIT

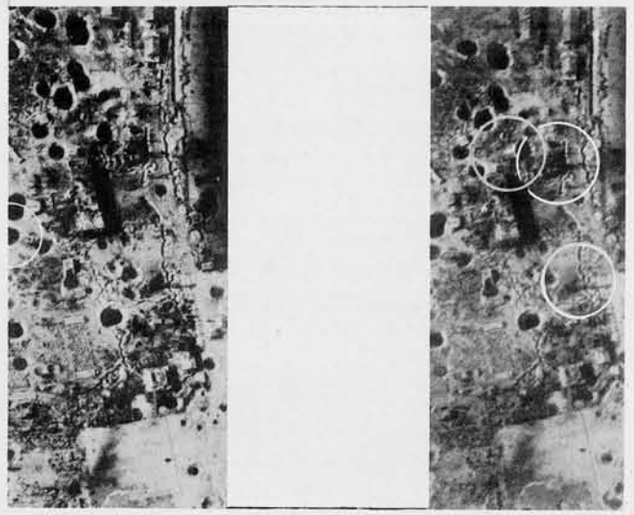
In these pictures of Jaluit Communications Center, in which the location of masts is very difficult to determine, the standardized type of concrete building serves well for identification purposes.

All of these concrete buildings contain fairly powerful transmitters in the Medium Frequency band. The approximate reliable range is 500 miles, but they may transmit a great deal further, especially at night.



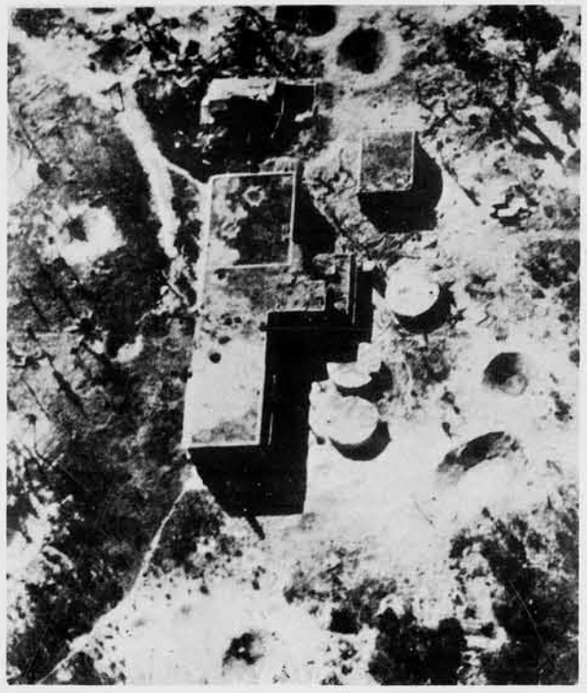
(R.F. - 1/1300±)

JALUIT



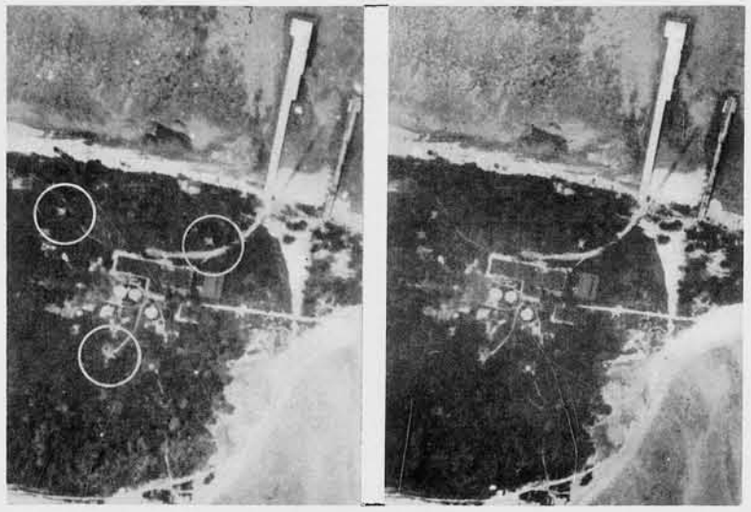
(R.F. - 1/4000)

JALUIT



PIGEEYATTO, MALOELAP, MARSHALLS

Standard building, water cooling tanks, oil storage building, and cisterns are all present. The cellular construction in the water-cooling tank building is visible in the partly destroyed example above.

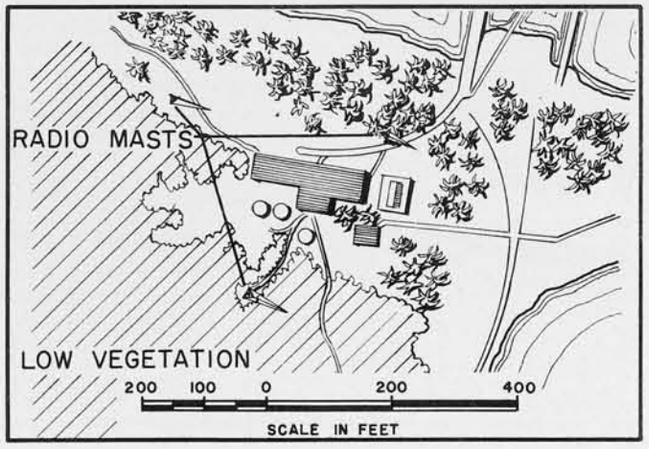


(R.F. - 1/2500)

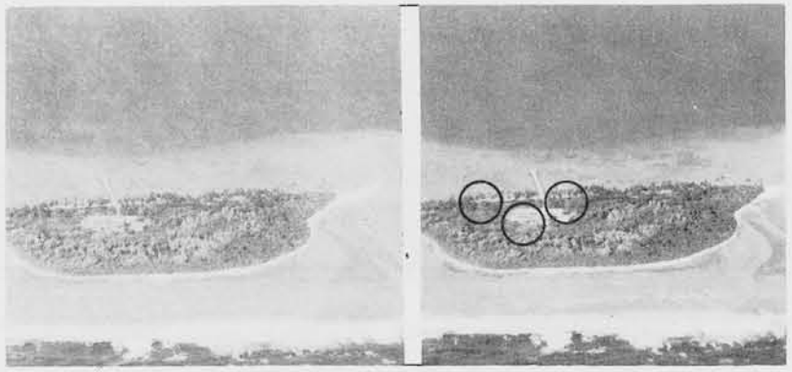
PIGEEYATTO, MALOELAP

Another Medium Frequency Communications Center at Maloelap. This station is located on Pigeeyatto Island.

Here the masts are of the same type and dimensions as at Taroa, i.e. 60 feet high, 175 foot spacing, and a single triangular platform at the top.



PIGEEYATTO, MALOELAP



ENNUBIRR, KWAJALEIN, MARSHALLS

The pictures and plans on this page are of a Medium Frequency Communications Center on Ennubirr Island, Kwajalein Atoll, Marshall Islands.

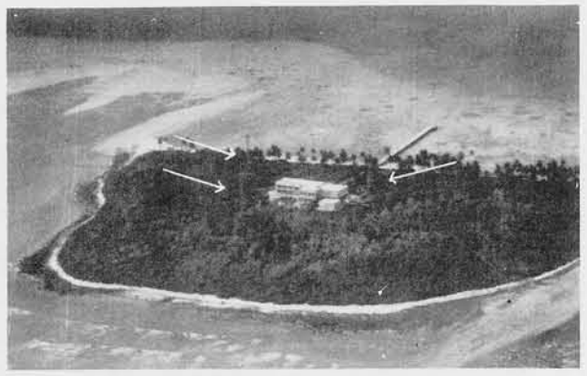
Apparently, the sole military use of this particular island was radio communication, and the "Standard" buildings and arrangement were employed.

(R.F. - 1/10000)

ENNUBIRR

This installation has three lattice towers, 75 feet high, which are spaced 350 feet apart. This indicates that it is a fairly powerful station in the Medium Frequency band (.3 to 3 mcs.) and probably has a reliable range of 500 to 800 miles when operating under normal conditions.

The Ennubirr Station is one of several communication stations at Kwajalein, which are mostly High and Medium Frequency, with one probable Low Frequency.

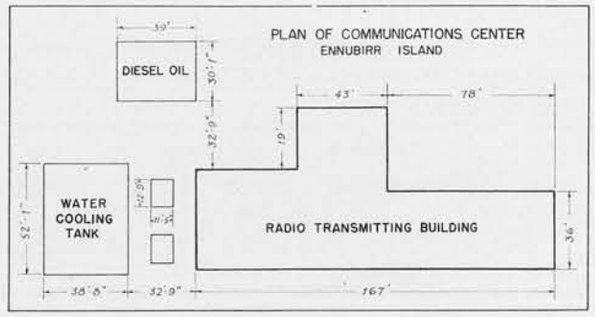


ENNUBIRR

The buildings are as follows: main concrete communications building, concrete oil storage building and three 20 foot diameter concrete cisterns. A long pier for transportation and supplies was necessary because of the shallow water over the coral reefs. This is evidently the only means of access to the island.

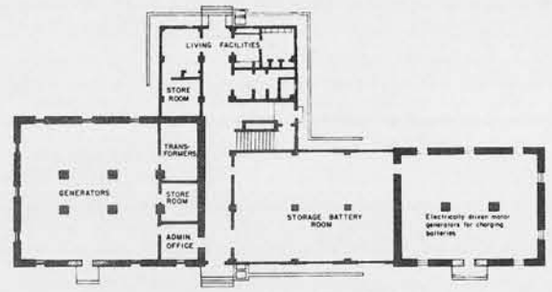
ENNUBIRR

From these examples it can be more forcibly realized the extent to which the Japanese have developed a Military Communication network throughout their empire. Ample and reliable communication facilities, throughout widely dispersed areas and involving great expanses of water, are an imperative need of the Japanese military machine hence their great reliance on radio.

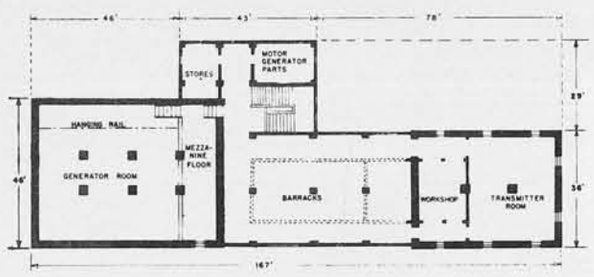


PLOT PLAN OF ENNUBIRR

The two small rectangles between the transmitting building and the water cooling building may represent exhausts for the Diesel engines. Water cooling tank buildings are built of wood with pitched roof and monitor. Oil storage buildings are usually concrete with flat roofs.



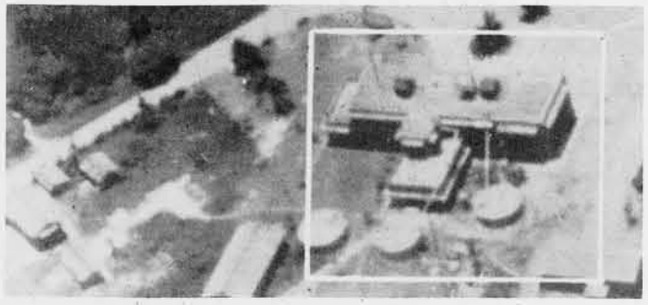
FIRST FLOOR PLAN



SECOND FLOOR PLAN

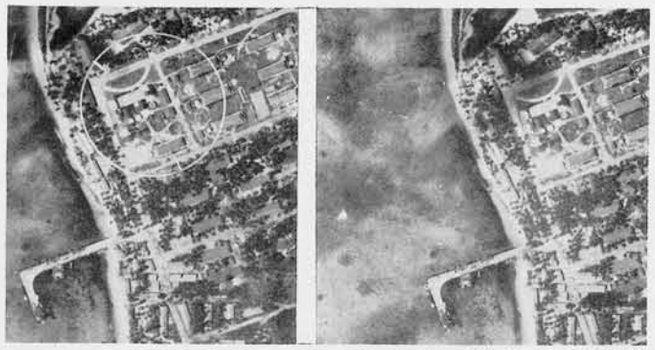
The first floor contains most of the services, engines and heavy equipment. The structure is heavy and well-built of reinforced concrete. The second floor contains most of the electrical equipment (such as the transmitter, which is most vulnerable and difficult to replace), and also barracks for the crew. The generator room ceiling is two stories in height.

COMMUNICATIONS
COMMUNICATION CENTERS (CONT.)



PALAU

This station at Pelelieu Island, Palau, is apparently the 75 foot mast, Medium Frequency standard type. However, there appear to be two additional 30 foot masts erected on top of the building. These latter masts probably carry antennae for High Frequency Communication. The absence of the water cooling and oil storage buildings suggests that power may be fed to this point from a remote station.



(R.F. - 1/10000)

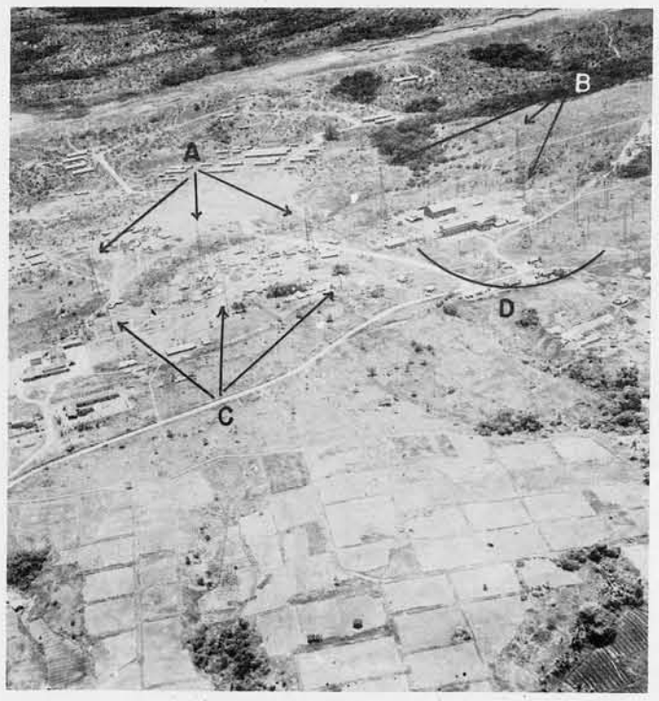
NAMUR, KWAJALEIN

This building is probably used as a command headquarters in addition to a message center.

The "Headquarters Building" on Namur Island, Kwajalein, is mainly a Communications Center, serving also as a command post, (which is true of many examples of this standardized type concrete building). This station transmits at Medium Frequency.

PALAU

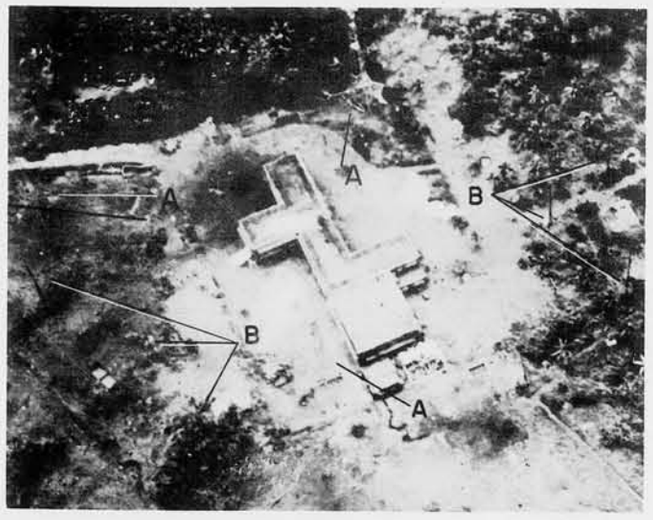
One of the largest Japanese Communication Centers seen to date is this one on Babelthuap Island, Palau. Such a station may operate on many frequencies, ranging from High to Low. It may be best described as a Multi-channel Communication Center.



PALAU

"A" - THREE 200' LATTICE MASTS (QUADRUPED)
"B" - THREE 250' LATTICE MASTS (TRIPOD)
"C" - THREE 150' ± STEEL STICK MASTS
"D" - SEVENTEEN (VISIBLE) WOOD STICK MASTS 50'-75' IN HEIGHT AND ONE STEEL STICK MAST, 150' HIGH.

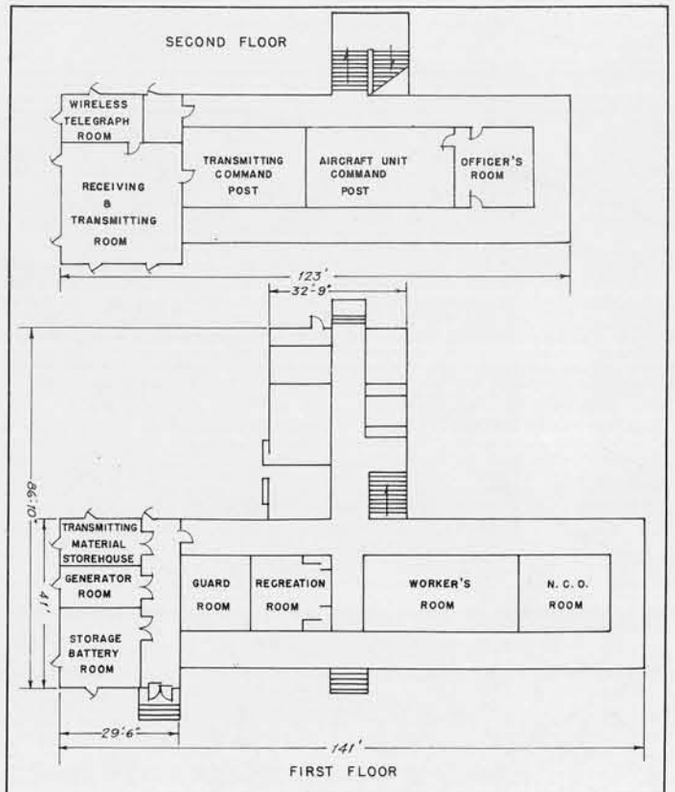
Small poles are power poles. All other masts visible probably support transmitting antennae.



TRUK

This station, because of its more elaborate mast system and the larger, more complex form of the communications building, appears to be of a multi-channel type, operating on Low, Medium, and possibly High Frequencies.

"A" - THREE 125' LATTICE MASTS
"B" - SIX 50' - 60' SPLICED WOOD STICK MASTS



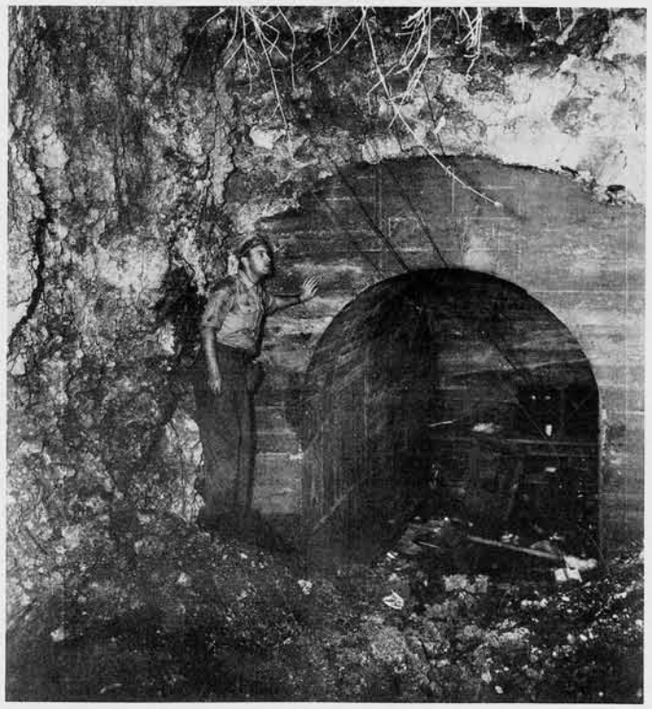
HEADQUARTERS BUILDING
NAMUR ISLAND

CONFIDENTIAL

CONCRETE - 25' x 35'

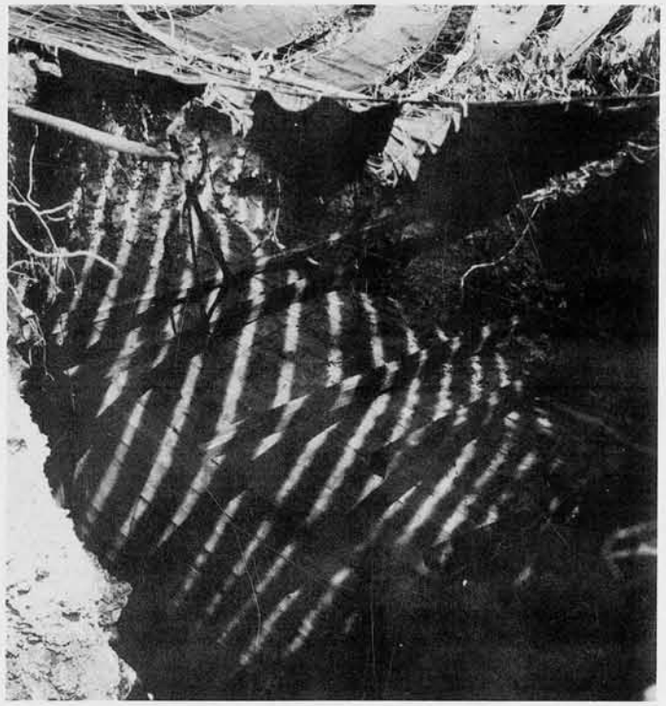
ABOVE: Two examples of bomb proof communications and command posts. These are quite small as compared with the concrete Communications Center Buildings. The design of heavy reinforced concrete varies considerably. The transmitters in these posts are probably high and medium frequency and are used in connection with ground troops and A. A. and C. D. batteries.

CONCRETE - 14' x 60'



ENTRANCE

Entrance to completed vault is shown here. Eight feet of coral backfill has been placed on top of vault which is 18 feet wide by 50 feet long (outside dimensions). Concrete is 2½ feet thick.



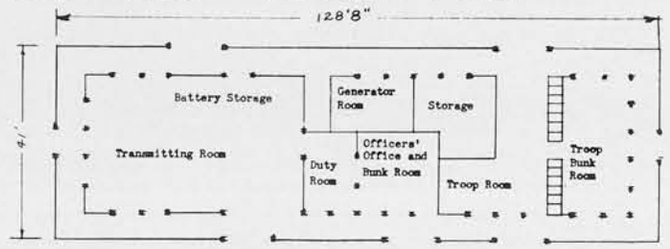
Exterior view of buried concrete barrel vault Communications Center at Guam, designed mainly for local ground force communication while under attack. These types are extremely hard to locate on aerial photos and are strongly resistant to bomb damage. Note camouflage during construction.

GUAM

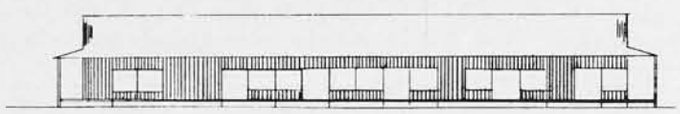
Interior view of concrete vault shown at bottom of page. Inside dimensions are 13' x 45'.

GUAM

Transmitter in small buried communications center. Observation of tracks and presence of antenna masts are clues to this type of station.



PLAN

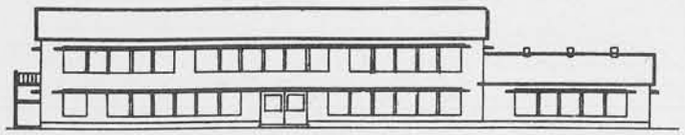


ELEVATION

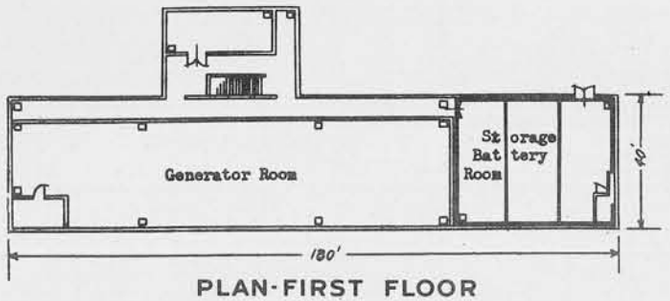
The standard Japanese prefabricated barracks building is used as a communications center in several instances. When radio masts are visible near barracks buildings, there is a good chance that the barracks nearest to them contains the transmitter. Transmitting rooms are invariably at the end of a building, and on the second floor, if a two story structure.

COMMUNICATIONS

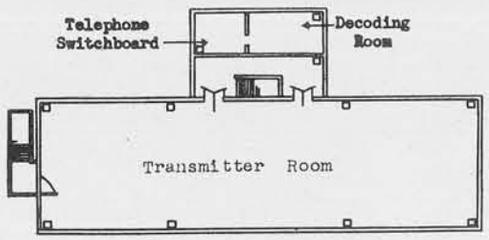
COMMUNICATION CENTERS (CONT.)



FRONT VIEW



PLAN-FIRST FLOOR



PLAN-SECOND FLOOR

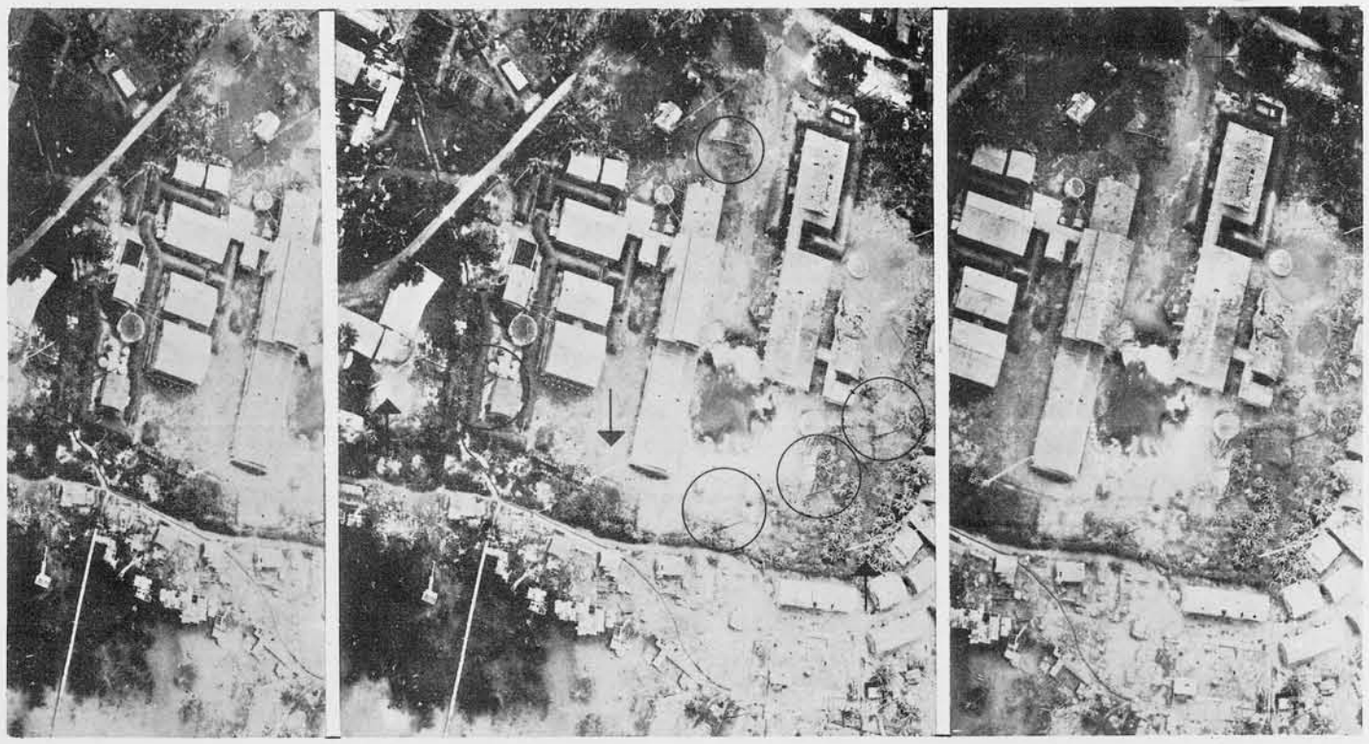
Another type of communications center which is apparently a development of the prefabricated barracks building. This structure is two-storied, with the transmitter on the second floor.

The design of Communication Center, at the southwest tip of Dublon Island, is curiously jumbled and makeshift for a station that is apparently quite powerful.

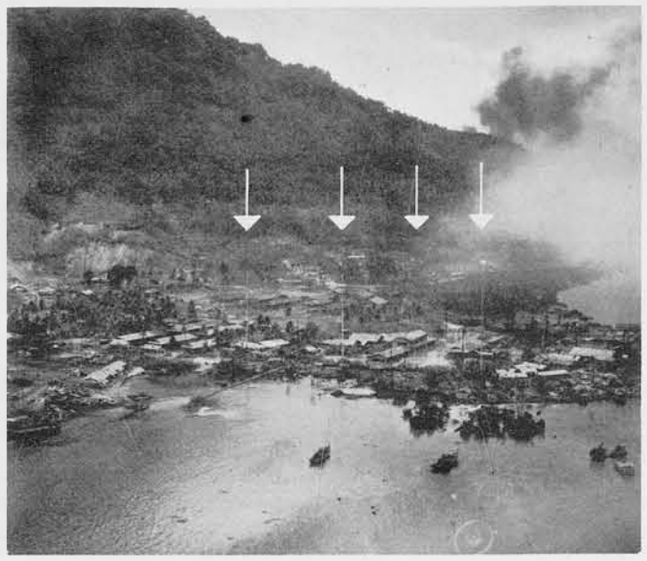
High and Medium Frequency transmitters are likely to be present, the latter with fairly good range. The tallest stick masts are 100 feet high; the spliced wood stick masts are about 60 feet.

FAR RIGHT: This Center, on the north side of Dublon town, utilizes three typical 125 foot lattice masts with platforms and an informal arrangement of stick and spliced wood stick masts. There is very likely a low frequency transmitter present in connection with the lattice masts.

All of the pictures on this page are examples of the use of prefabricated barracks-type buildings in connection with Communication Centers. Most are one story in height and are 38 feet wide, including roof overhang.

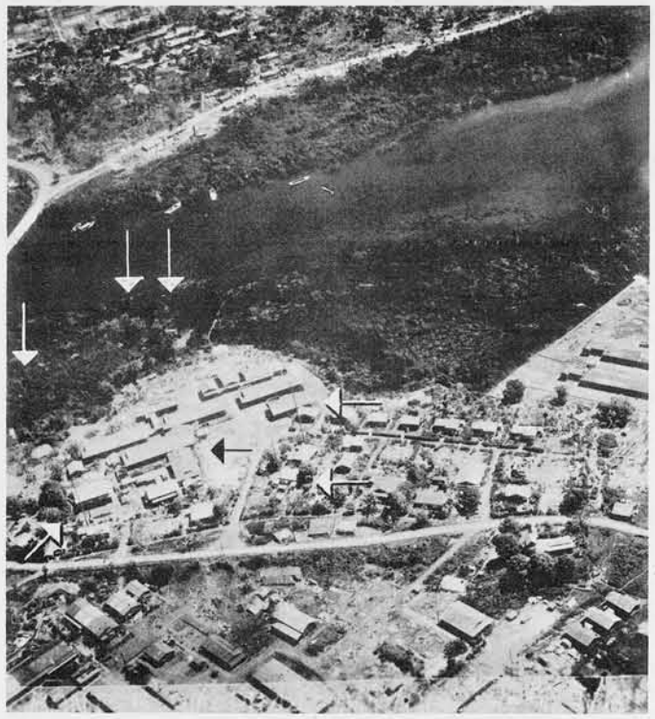


S. W. DUBLON, TRUK



S. W. DUBLON, TRUK

This communication center at Truk is a multichannel station operating at various frequencies including long range, medium or low frequency. The informal, jumbled nature of the group is not very typical of the larger stations.



DUBLON TOWN, TRUK

COMMUNICATIONS
WEATHER STATIONS

Japanese military Weather Stations are fairly easily recognized in small scale photography by the following features:

1. 50'-60' steel (sometimes wood) tower containing wind instruments for recording speed and direction and/or low wooden platform constructed on top of roof of main building.

2. Three small white-painted instrument houses, usually in line. These are roughly 3' to 5' square - but show up very plainly because of their pure white color.

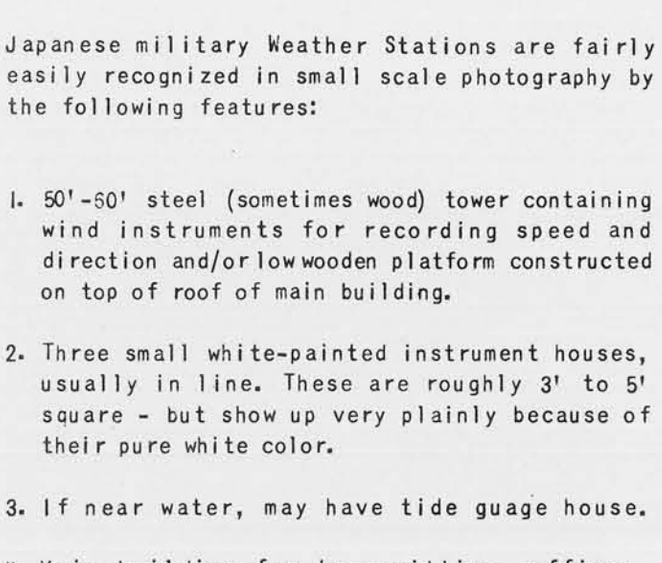
3. If near water, may have tide guage house.

4. Main building for transmitting, offices, quarters, etc.

5. Other buildings present are likely to be barracks, generator building, oil storage and water storage.

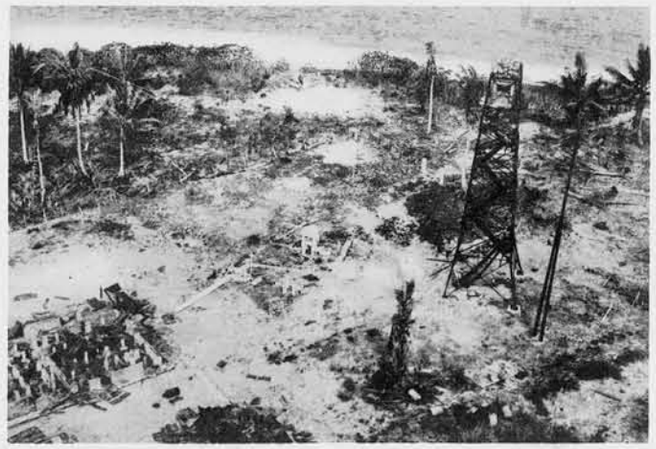
6. Two spliced wood stick masts supporting antennae for reporting station.

BELOW: This weather station at Yap is unusual in that four stick masts are used for communications. In most stations, only the two spliced masts are present.



(R.F. - 1/5000)

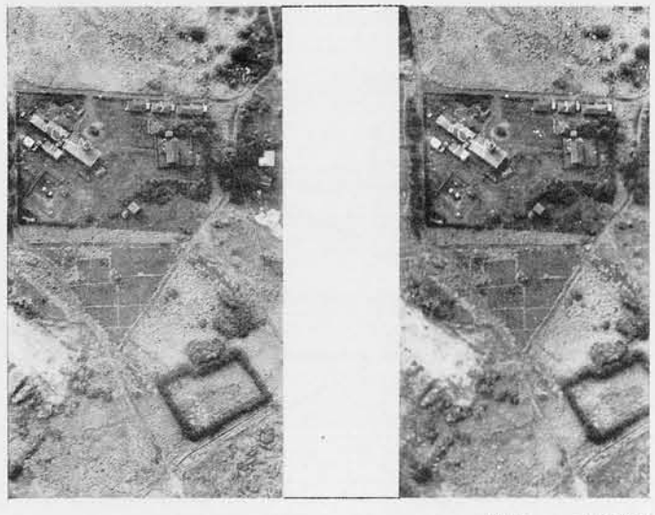
YAP



NAMONUITO, CAROLINES

(R.F. - 1/9100)

IWO JIMA, KAZAN



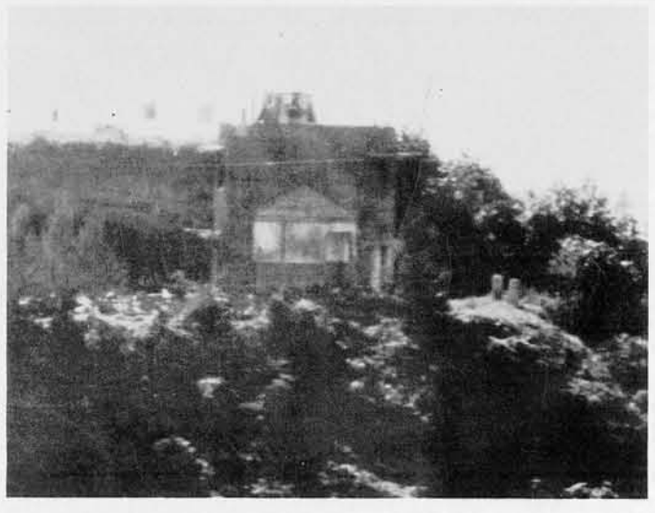
(R.F. - 1/5000)

IWO JIMA, KAZAN

NAMONUITO, CAROLINES

(R.F. - 1/4000)

MAUG, MARIANAS



MAUG, MARIANAS

CONFIDENTIAL

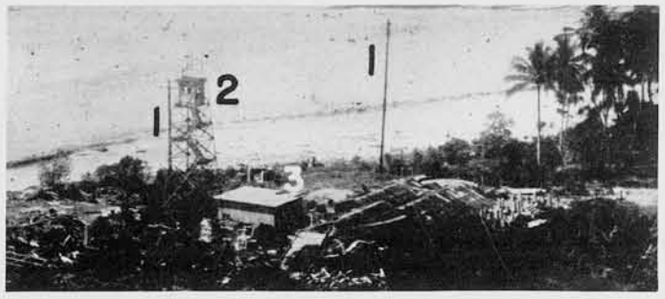
COMMUNICATIONS
WEATHER STATIONS (CONT.)

KAVIENG, NEW IRELAND

"A" - SPLICED WOOD STICK MASTS
"B" - PROBABLE GENERATOR BUILDING
"C" - WEATHER INSTRUMENT HOUSES

UJAE, MARSHALLS

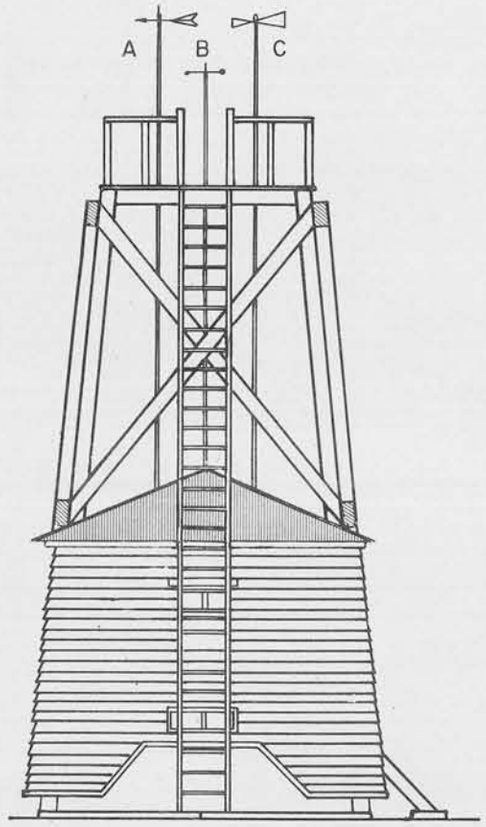
"A" - STICK MAST
"B" - PROBABLE GENERATOR BUILDING
"C" - TOWER FOR WIND RECORDING INSTRUMENTS
"D" - WEATHER INSTRUMENT HOUSES
"E" - TIDE GAUGE HOUSE



KAPINGAMARANGI, CAROLINES

"1" - TWO 75 FEET HIGH STICK MASTS WITH CROSS PIECES AT TOP.
"2" - WEATHER STATION TOWER.
"3" - PROBABLE GENERATOR BUILDING.

A tide gauge house is probably present.



ELEVATION

Drawing of a Japanese Weather Station tower, showing instruments common to this installation.

"A" - WEATHER VANE.
"B" - ANEMOMETER.
"C" - VENTURI TUBE FOR RECORDING WIND VELOCITY.

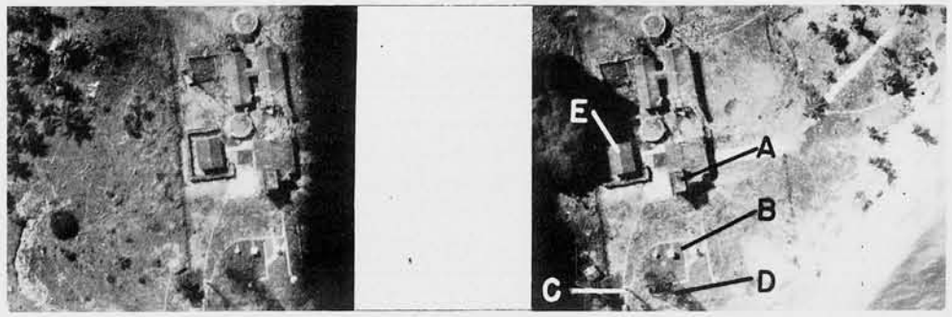
NGULU, CAROLINES

TAONGI, MARSHALLS

This weather station at Taongi is identified by the tower platform atop the main building and by the presence of radio masts.

A tide gauge house is probably present.

NGULU, CAROLINES



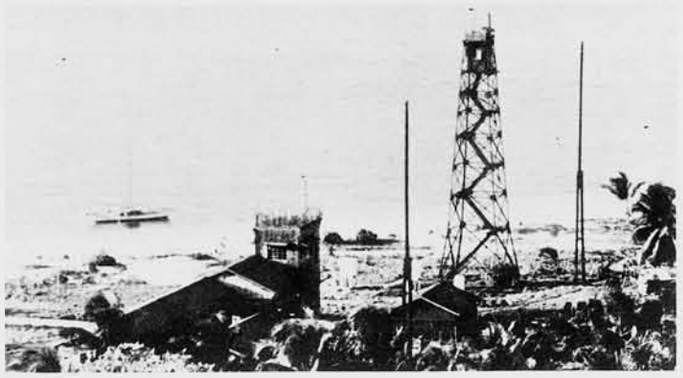
(R.F. - 1/2000)

RONGELAP, MARSHALLS

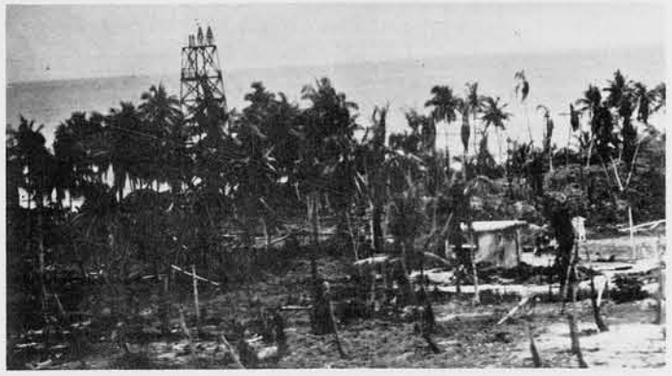
"A" - TOWER PLATFORM
"B" - WEATHER INSTRUMENT HOUSES
"C" - STICK MAST FOR RADIO
"D" - STEEL TOWER
"E" - PROBABLE GENERATOR BUILDING

"A" and "D" are both used for recording wind direction and velocity. Note strong pattern created by weather instrument houses. These houses contain instruments for determining temperature and barometric pressure and include recording barographs. They are always painted white in order to get standard constant readings.

PINGELAP, MARSHALLS



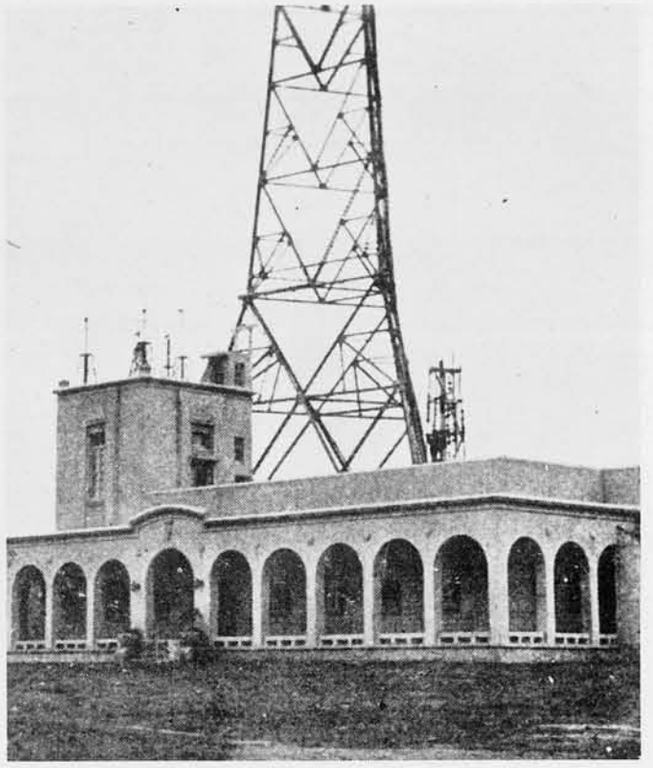
RONGELAP – BEFORE



ULITHI, CAROLINES

RONGELAP – AFTER

ULITHI, CAROLINES



NAHA, OKINAWA

Example of a large pre-war Weather Station

COMMUNICATIONS

GERMAN

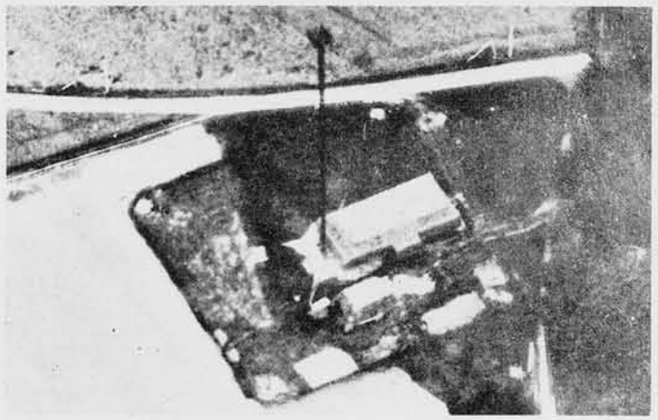
German Radio practice differs in many ways from the Japanese, and examples are shown on these two pages to illustrate this fact.

Most German radio is likely to be in the High or Very High Frequency bands, although Medium Frequency is used also. Very few Low Frequency stations are found, however.

A collection of tall, (300 feet high) lattice masts is likely to mean a powerful short wave transmitter, rather than Low Frequency as would be the case in Japanese stations.

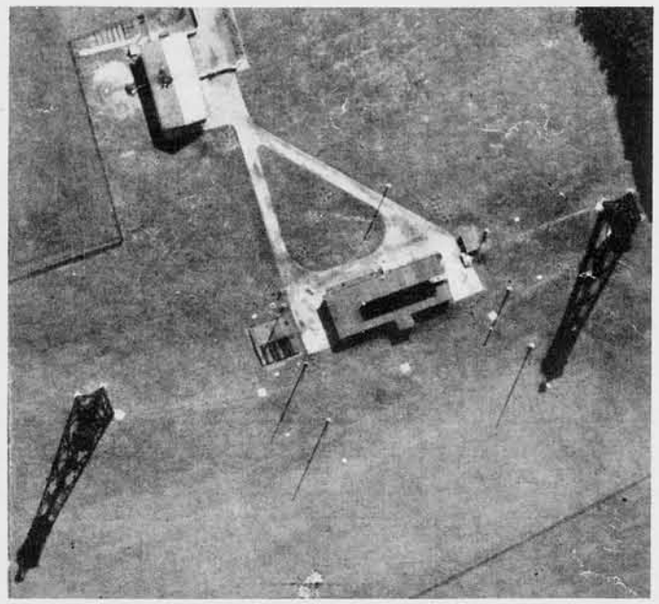
The Germans also employ point to point relay stations at V.H.F. (Decimeter Stations) and High Frequency directional layouts.

DECIMETER STATION

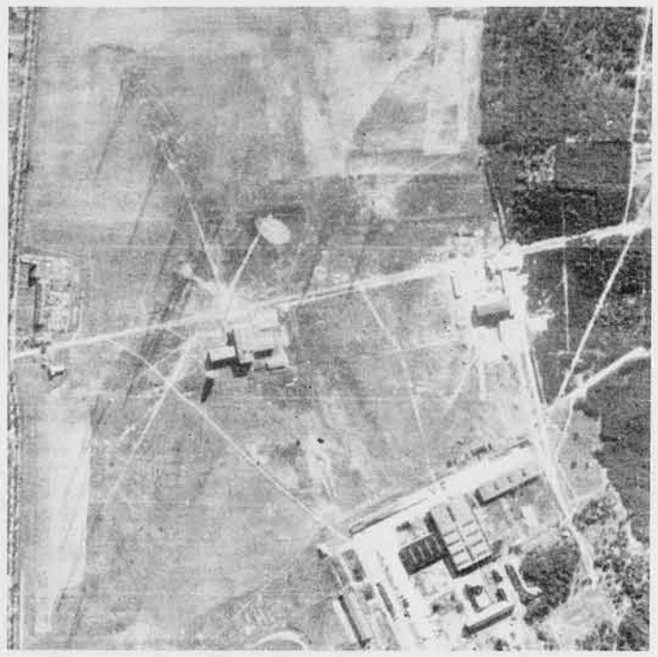


DECIMETER STATION

The above German Decimeter Station is near Le Havre, France. This equipment, widely used for German point to point communications, is Very High Frequency. The stations are spaced 30 miles apart and have masts 160 feet high.

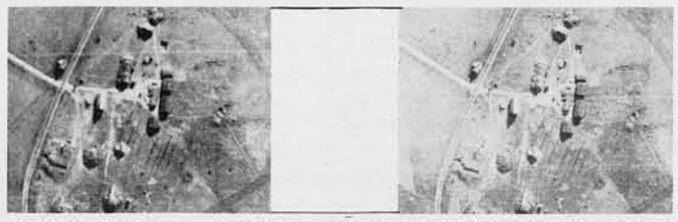


GERMAN



POWERFUL SHORT WAVE

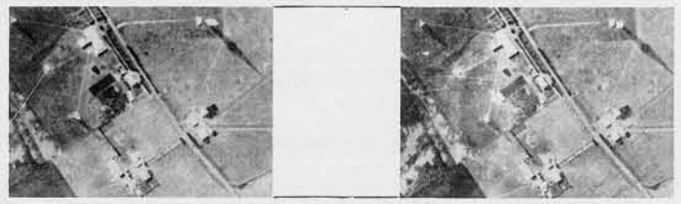
Giant short wave High Frequency transmitter, Zeesen. There are 10 masts 350 feet high. When high lattice masts are used in German radio, it is likely to indicate powerful High Frequency transmission. In Japanese-held territory, however, such masts would be likely to represent Low Frequency.



(R.F. - 1/9000±)

FIELD RADIO

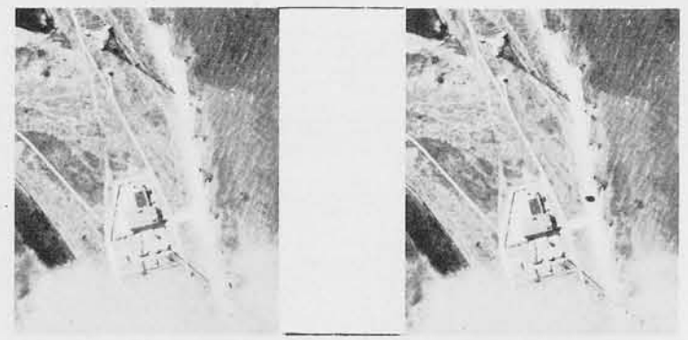
This German field radio station is similar to certain Japanese headquarters stations.



(R.F. - 1/10000±)

BROADCAST STATION

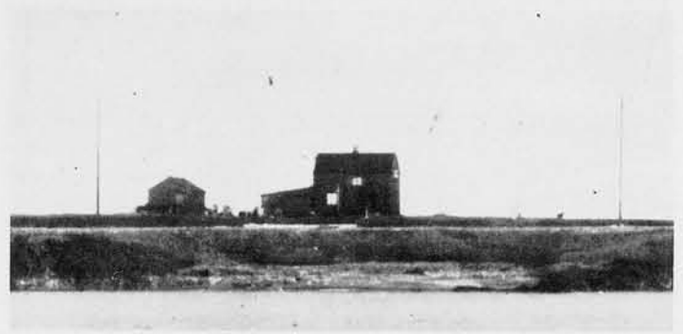
This station is a commercial station. Note German type lattice masts.



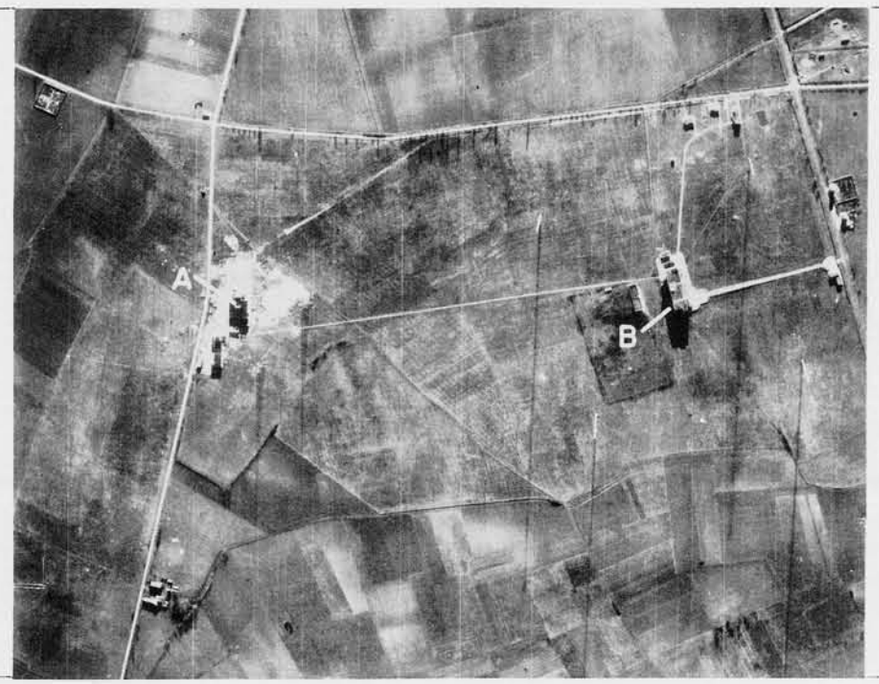
(R.F. - 1/2500 - no parallax)

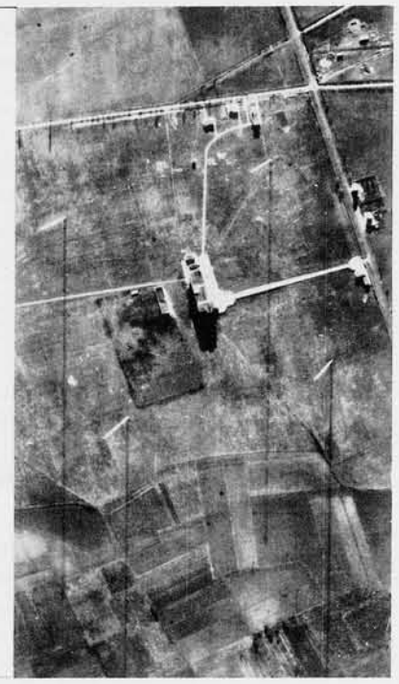
DENMARK

These masts are approximately 350 feet high, spaced 250 feet apart, and indicate a powerful shortwave transmitter.



WEATHER STATION, SPITZBERGEN





BOURGES, FRANCE

Two very large stations under construction at Bourges.

Station "A" consists of 4 masts 800 feet high, insulated at base and guyed to concrete deadmen. The square pattern is ¼ mile on a side.

Station "B" consists of two lattice masts 350 feet high spaced 480 feet apart. Small stick masts, irregularly spaced, are present also, and may constitute an earth device.

These stations probably will operate on many different frequencies and will have great range. Station "A" is of French radio design; a similar type installation may be seen at Saigon, French Indo China.

VALHERMIEL, FRANCE

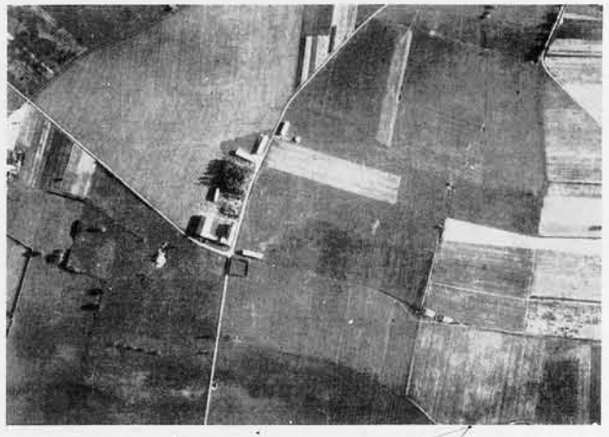
View of German type High Frequency masts with some stick masts of a directional Rhombic layout in the background. This station also has Medium Frequency masts (not shown).

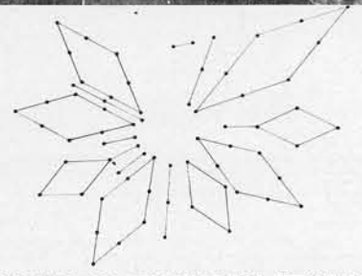
Antennae on High Frequency masts are probably in a vertical position.

(R.F. - 1/10000±)

GERMANY

Probable Medium Frequency Communication Station at an aircraft plant in Germany. The small square building probably contains the transmitter.





ROANNES CHANCEY, FRANCE

Directional Rhombic layout in France. This pattern may be used for highly directional transmitting and receiving of communications. It is a common Radio Intercept pattern.

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY MATERIAL